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HEALTH PROMOTION: PREDICTING PHYSICAL ACTIVITY IN NORMAL WEIGHT AND OVERWEIGHT RURAL ADOLECENTS

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DEDICATION

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HEALTH PROMOTION: PREDICTING PHYSICAL ACTIVITY IN NORMAL WEIGHT AND OVERWEIGHT RURAL ADOLECENTS

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Adolescent obesity is ubiquitous and is often antecedent to adverse physical and psychosocial health outcomes. Physical activity is a leading modality for preventing and treating overweight and obesity. A modified resilience framework was used in this study to examine six empirically supported risk factors for physical inactivity and low activity (i.e., body mass index, media use, parental activity, Hispanic ethnicity, minority race, and female sex) along with moderating protective resources (i.e., sense of ethnic identity, health awareness, and social connectedness).

The study sample consisted of 251 adolescents, in Grades 8 and 9, recruited from three rural and economically disadvantaged school districts in the southwestern U.S. Data were retrieved from the *Longitudinal Health Risk Behaviors in Youth* (LongHerby; Grade 8) and *Developing Health Behaviors in Middle Adolescence* (DHBMA; Grade 9) databases for this secondary analysis of extant longitudinal data. One parent of each

participant contributed data used in the study. Demographic analysis revealed the sample was mostly of female sex (56%), White race (81%), and non-Hispanic ethnicity (55%).

A descriptive, correlational design was used to examine relationships among variables. Data analysis included correlation, linear regression, and hierarchical multiple regression techniques. The findings showed the outcome of physical activity in Grade 8 was the most statistically significant predictor of physical activity in Grade 9, using two different measures for the outcome (i.e., the Youth Risk Behavior Surveillance Scale [YRBSS] and the Adolescent Lifestyle Questionnaire [ALQ]). Two hierarchical multiple regression models explained 20% (YRBSS) and 21% (ALQ) of the variances in adolescent physical activity practices with female sex ($R^{2\Delta} = .101$, $p < .001$; YRBSS) and health awareness ($R^{2\Delta} = .114$, $p < .001$; ALQ) contributing the largest proportion to the hierarchical variances. Body mass index percentiles were not correlated with physical activity (YRBSS or ALQ), but did show a small inverse correlation with female sex ($r = -151$, $p = \leq .005$) and a small positive relationship with Hispanic ethnicity ($r = .168$, $p = \leq .001$). Findings of this study are congruent with previous research and could be used in planning health promotion strategies to improve adolescent physical activity.

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CHAPTER I: INTRODUCTION

Adolescence is a dynamic phase in the life course marked by tremendous growth and development. Adolescents are full of robust energy and vitality, curiosity about the world, and they are characteristically healthy, with a low risk for illness. Adolescence is also a time of exploration and experimentation in the development of a personal identity and finding one's place in the world. Within this period of experimentation there is a heightened vulnerability to contextual and behavioral risks that can result in negative physical and psychosocial health consequences (Curtis et al., 2011; MacKay & Duran, 2008). Successful adolescent development includes surmounting the hurdles that are associated with the risks and vulnerabilities of adolescence. This is an individual and complex process known as resilience and implies that individuals can traverse the vulnerabilities created by risk factors and risk experiences, and achieve healthy outcomes rather than serious sequelae (Fergus & Zimmerman, 2005; Rutter, 2007). A successful resilience trajectory depends upon the nature of the protective resources within the adolescent's personal and social ecology (Compus & Resslund, 2009; Fergus & Zimmerman, 2005; Masten, 2001).

Childhood obesity is ubiquitous and is often an antecedent factor for adverse physical and psychosocial health outcomes. The Centers for Disease Control and Prevention (CDC, 2011b) categorizes both overweight status and obese status in children and adolescents aged 2-19 years as childhood obesity. Obesity is related primarily to two risk factors, physical inactivity and poor dietary habits (Lambourne & Donnelly, 2011). A direct relationship has been found between higher levels of physical activity and higher

levels of energy expenditure (Fogelholm, 2008; Harrell et al., 2005) and the healthy weight status of children (Strong et al., 2005). This study examined adolescent physical activity participation, using a modified resilience framework. Six empirically supported risk factors for physical inactivity (body mass index, media use, parental activity, Hispanic ethnicity, minority race, and female sex) along with moderating protective resources (sense of ethnic identity, health awareness, and social connectedness) were examined. The selected moderators were supported in the literature as protective against health-risk behaviors in adolescents. Data from two existing cohort sequential, longitudinal studies, *Longitudinal Health Behaviors in Youth* (LongHerby) collected during early adolescence when the participants were in grades 4-8 and *Developing Health Behaviors in Middle Adolescence* (DHBMA) collected during the middle adolescent phase when the same participants were in grades 9-12, were used for this correlational, secondary analysis.

The physiological nature of body weight regulation is challenged in today's environment. In previous eras, high levels of physical activity were the driving force of daily energy balance and stimulated eating to avoid body energy loss. Over time, physical activity has been diminished by advances in industry, transportation, and technology (Weller & Bawden, 2005). Furthermore, Americans' food habits have changed as the existing food supply in the United States has burgeoned and portion sizes have increased. Obesogenic food is high in energy and fat and often is more affordable and more palatable than lower calorie foods (CDC, 2006). Expending less daily energy through less

physical activity and individual over nutrition both contribute significantly to the current obesity epidemic (Steinbeck, 2001).

This study focused on physical activity because expert panels recommended increased daily physical activity as the leading modality for preventing and treating overweight and obesity in Americans of all ages and for maintenance of weight loss (American Heart Association, 2012; National Institutes of Health, 1998; U.S. Department of Health and Human Services [USDHHS], 1996). As Americans continue to gain weight throughout childhood and into the adult years (Daniels, 2006; Gordon-Larsen, Adair, Nelson, & Popkin, 2004), the challenge of weight management is to increase energy expenditure to match the higher levels of daily energy intake (Barlow & The Expert Committee, 2007).

With the advent of the obesity pandemic and the subsequent associated chronic disease outcomes, the sustainability of adolescent health through adulthood is in peril. Our current generation of adolescents may very well have a shorter lifespan than their parents (Daniels, 2006). Obesity is a serious physiological disease and curtailing the epidemic should be viewed in context to primary, secondary, or tertiary prevention efforts directed at increasing daily physical activity participation. Increasing adolescent physical activity levels contributes to long-term weight loss and weight management, thereby preventing or reducing the impact of obesity on associated health-risks (Calderon, Yucha, & Schaffer, 2005; Hills, Anderson, & Byrne, 2011; Strong, et al., 2005; Weichselbaum & Buttriss, 2011).

Purpose

The purposes of this dissertation were four-fold: (1) to describe modifiable risk factors for physical inactivity (body mass index, media use, and parental activity), (2) to describe the protective resources for physical activity (sense of ethnic identity, health awareness, and social connectedness), (3) to examine the relationships among the risk factors, protective resources, and adolescent physical activity participation, and (4) to determine if there is a moderating relationship between the protective resources and risk factors.

Background and Significance

Many developmental changes occur during adolescence including the establishment of lifestyle habits that persist through adulthood (Hills, King, & Armstrong, 2007). The obesity epidemic has slowly emerged and escorted subtle changes into the healthful adolescent landscape, foreshadowing an array of negative health outcomes such as hypertension, insulin resistance, and atherosclerosis (Dietz, 1998; Reilly & Kelly, 2011; Vos & Barlow, 2011). The adolescent obesity epidemic is thriving, has altered the backdrop of healthy adolescent development, and continues to threaten the health and lives of adolescents.

The overall health and well-being of Americans dramatically and consistently improved throughout the 20th century. Life expectancy at birth, for males and females, and all races, from 1900 to 2000 increased from 47.3 to 77 years of age (CDC, 2008). During this time, the leading causes of death were heart disease, cerebrovascular diseases, diabetes mellitus, essential hypertension, and hypertensive renal disease and

obesity is a common risk factor for these morbidities. Public health and medical advancements, geriatric specialists, and multidisciplinary care, that integrate evidence-based health-promotion strategies, have each contributed to improved life expectancy (Arai et al., 2012), such that life expectancy during the first decade of the current millennium has continued to improve (CDC, 2008).

Physical inactivity is an independent, modifiable risk factor that leads to obesity and other chronic diseases that contribute to 3.2 million deaths annually (World Health Organization [WHO], 2011d) and is implicated as the second leading actual cause of death in the United States (Mokdad, Marks, Stroup, & Gerberding, 2004; USDHHS, 2010). Obesity is the most significant outcome of a physically inactive lifestyle (Pietiläinen et al., 2008). This phenomenon is reflected in the increased global prevalence rates of childhood obesity. Over the past 20 years, in the United States alone, obesity has more than tripled in adolescents (CDC, 2010c) and as a result, adolescent risk for a myriad of health complications has emerged (CDC, 2010c; Vivier & Tompkins, 2008). The escalating trends in adolescent obesity and the consequential risk for associated chronic disease continues into adulthood, leading to premature and preventable causes of death. Obesity also creates psychosocial distress such as depression or low self-esteem and can lead to fiscal barriers related to a lack of access to further educational opportunities, which often delay the process of transitioning into adult well-being (Arnett, 2000; CDC, 2009; Finkelstein & Trogdon, 2008; Furstenberg et al., 2004).

In response to the adolescent obesity epidemic, multi-disciplinary researchers have focused on improving adolescent participation in daily physical activity as a simple

health promotion strategy to reduce the incidence and prevalence of overweight and obesity. Physical activity has numerous health benefits and in sufficient amounts expends calories beyond daily metabolic needs and offsets daily caloric intake. Deficient amounts of daily activity result in an energy surplus that is directly associated with health risk factors such as elevated body mass index, increased waist circumference, hypertension, and elevated blood glucose and triglyceride values (Cook, Weitzman, Auinger, Nguyen, & Dietz, 2003; Sharma, 2006).

The Healthy People (HP) 2010 initiative targeted the prevention of overweight and obesity in adolescents by focusing on physical activity as a leading health-indicator (USDHHS, 2008a). Although not reaching HP 2010 benchmarks, adolescents modestly increased physical activity levels between 1991-2007, and as a whole they were not less active than before 1991 (Li, Treuth, & Wang, 2010). However, there remains a need and there is still opportunity for improvement in adolescent physical activity trends. Thus, the Healthy People 2020 objectives have extended this initiative (USDHHS, 2011). In addition, reducing popular adolescent sedentary behaviors such as television viewing and computer screen time remains salient to improving adolescent physical activity behaviors (USDHHS, 2011).

Curbing the obesity epidemic is a fundamental goal for promoting adolescent health. Identifying factors that protect adolescents from the risks that challenge their participation in physical activity is a key step toward health promotion. Improving the level of habitual, moderate or vigorous intensity physical activity is a priority goal for adolescent health promotion and disease prevention agendas (CDC, 2012a). The major

constructs to be explored in this study include risk factors that lead to physical inactivity, protective resources that potentially mitigate adolescent vulnerability to the risk factors, and physical activity participation as a health-promoting behavior and resilience outcome.

Physical Activity

Energy expenditure includes three basic components: resting metabolic rate (RMR), thermogenesis, and physical activity. RMR, synonymous with resting energy expenditure, is the energy the body requires to perform vital functions, while the body is at rest. Approximately 60% of the calories needed per day are spent with RMR (Donahoo, Levine, & Melanson, 2004). Lean body mass and physical activities increase the RMR. Thermogenesis, or the thermic effect of food (TEF), occurs during the process of digestion, absorption, storage, and oxidation of nutrients. TEF accounts for approximately 10% of daily energy needs and is a constant proportion of energy expenditure (Levine, 2007). The third component of energy expenditure is physical activity participation, which includes any activity that involves the movement of the human skeletal muscles and expends energy (WHO, 2011a), and is the focus of this study.

There is a small body of published research reporting physical activity patterns among sex, race, and ethnic groups in the United States. The data consistently reflect that physical activity varies by race and ethnicity and the amount of physical activity performed, declines with age, particularly in females. Seventy percent of American adults are inactive or sedentary and engage in less than the recommended level of physical

activity for health benefits (Booth & Chakravarthy, 2002), which is less than 150 minutes per week of moderate-intensity physical activity (USDHHS, 2008b). Therefore, an understanding of factors that promote and inhibit engagement in physical activity during adolescence is of particular importance in health promotion efforts for adults (Gordon-Larsen et al., 2004). Analyzing the extant adolescent physical activity data available in the LongHerby and DHBMA databases is beneficial to validate published research findings and provide questions for future research studies. More importantly, the contribution of new evidence provides a clearer focus for planning adolescent health promotion programs directed toward ameliorating physical inactivity and the resulting chronic sequelae across the lifespan.

Gaps in Previous Research Findings

This study is significant in that it is built upon previous obesity research findings and recommendations. A review of the research evidence indicates a void in the body of knowledge regarding adolescent physical activity participation, examined from a resilience perspective. Few studies examine the selected protective resources individually as moderators to promote adolescent physical activity participation. Nearly half of the sample in LongHerby and DHBMA are of Hispanic ethnicity. Examining the relationships among the risk factors, protective resources, and adolescent physical activity participation in this ethnic population will contribute important empirical data for multi-disciplinary scientists to build upon, toward improving adolescent participation in physical activity.

Statement of the Problem

Obesity is of epidemic proportions among American adolescents. Physical inactivity is antecedent to obesity that contributes to adolescent and adult chronic diseases. Teague, Mackenzie, and Rosenthal (2007) reported that 63% of American adolescents have two or three of the five major risk factors preceding chronic disease. Adult morbidities associated with adolescent obesity are type 2 diabetes mellitus, coronary heart disease, gout, cancer, and hip fracture. Chronic diseases and complications require an inordinate amount of state and federal healthcare funds, and lead to the premature death of thousands of Americans annually. Elucidating specific risk factors and protective resources related to adolescent participation in physical activity and determining if a moderating relationship exists between them is central in demonstrating a positive resilience trajectory toward adolescent physical activity participation and developing interventions to curb the obesity epidemic.

Research Perspective – Resilience Theory

Resilience implies that individuals can surmount the vulnerabilities created by risk factors and risk experiences, and achieve healthy outcomes rather than serious sequelae (Fergus & Zimmerman, 2005; Rutter, 2007). The vital components of resilience are risk factors and protective assets or resources (Fergus & Zimmerman, 2005), which are sometimes labeled as protective resources (Rew & Horner, 2003) or protective factors (Compas & Reeslund, 2009). As resilience research has evolved, a focus toward health-promotion has emerged. Researchers have focused on identifying personal attributes and social resources that protect adolescents from innate and extrinsic risks in order to avoid

or temper adverse physical and psychosocial health outcomes. It is important to explain how adolescent protective variables interact with the risk factors contributing to physical inactivity in adolescents. Stewart, Reid, and Mangham (1997) issued the charge that future nursing studies should be based on previous findings, include identified protective resources, and be relevant to the maintenance and promotion of the multiple dimensions of adolescent health and development.

Resilience research in culturally diverse populations extends the breadth of scientific understanding of the theory. LongHerby and DHBMA were cohort, sequential longitudinal studies with diverse ethnic and racial adolescent participants. The data measuring the risk factors for physical inactivity in Grade 9 were found in both the LongHerby and DHBMA databases, whereas the protective resources were only measured in the DHBMA study when participants were in Grade 9. Drawing from the DHBMA database provided an opportunity to explore interactions between risk factors for physical inactivity and protective resources for physical activity, among a group of culturally diverse adolescents. Cultural contexts included race, ethnicity, and sex, while diversity is defined as a variation among these variables (Lerner, 1995). Newman and Blackburn (2002) posit there is a gender difference in a resilience trajectory beginning in pre-adolescence as females manifest individual resilient attributes earlier than males.

Conceptual Model

Health promoting behaviors of adolescents cannot be explained in a simple manner, as they are the result of complex relationships among several different factors. It is important that we learn more about the utility of a resilience theoretical approach to improving adolescent health outcomes, through physical activity participation. Resilience implies that individuals transcend vulnerabilities and achieve healthy outcomes in the face of risks or adversity (Naglieri, LeBuffe, & Ross, 2013; Rutter, 2007). The conceptual model for adolescent physical activity participation developed for this study (Figure 1) was built upon research synthesized from a variety of disciplines, and is an adaptation of the model presented by Rew and Horner (2003), which framed the parent DHBMA study. The theory-based, conceptual resilience model illustrated (1) risk factors for physical inactivity, (2) protective resources for physical activity participation, and (3) physical activity participation as the health promoting outcome behavior that represents a resilience trajectory.

The risk factors selected for this study were empirically associated with physical inactivity in adolescents. These included female sex, minority race, and Hispanic ethnicity, which are not amenable to change, along with elevated BMI percentile, excessive media use, and parental physical inactivity, which are amenable to change. The protective resources are all amenable to change. Positive sense of ethnic identity, health awareness, and social connectedness are protective factors associated with adolescent engagement in health-promoting practices and moderators for health-risk behaviors (Bernat & Resnick, 2009; Love, Yin, Codina, & Zapata 2006; Nasim, Belgrave, Jagers,

Wilson, & Owens, 2007; Wharf-Higgins, Begoray, & MacDonald, 2009; Youngblade et al., 2007). No empirical evidence was found that associates the selected protective resources specifically with adolescent physical activity participation. Health-promoting behavior refers to personal actions that sustain or improve health and wellness (Mosby, 2009). In this study, health-promoting behavior referred to the frequency and intensity that adolescents engaged in physical activity.

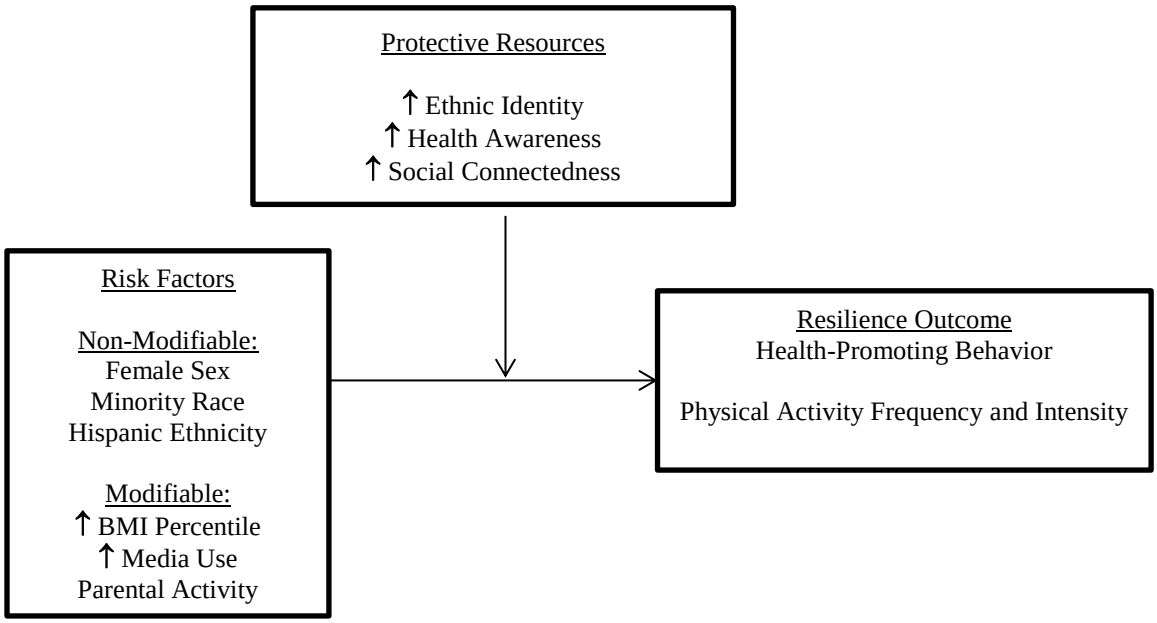

Figure 1. Conceptual Model of Adolescent Health-Promoting Behavior

Essential components in the resilience process are protective resources that moderate risks, within the context of a specific outcome (Fergus & Zimmerman, 2005). This study provides important descriptive information about leading risk factors and protective resources associated with adolescent physical activity participation among a large racially and ethnically diverse adolescent population from the southwestern US.

Although found in the adolescent literature, the protective factors ethnic identity and health awareness were selected for this study because they remain relatively unexplored in the nursing literature, within the resilience context. Social connectedness has been studied extensively in relation to resilience but studies are limited that investigate this protective factor with adolescent physical activity participation. Scientific inquiry into and description of the protective resources among the diverse participant population will enrich nursing science and add critical evidence to the minute amount of literature associating resilience and adolescent physical activity participation. Accordingly, the study describes the protective effects that indicate a resilience trajectory toward adolescent physical activity participation, as a health-promoting behavior. The nature of the relationships could provide a foundation and springboard for future research, focused on developing and testing the utility of health-promoting interventions that improve adolescent participation in physical activities.

Health-Promoting Behavior

Participating in health promoting behaviors is a positive and pro-active approach to health that improves the well-being of individuals. Adolescent health promoting behaviors are rooted within the adolescent's developmental stage, propensity for risk taking behaviors, and available protective assets and resources. The extant databases of LongHerby and DHBMA provided data that lent to focusing on adolescent health promotion by use of scales that measure empirically supported risk factors for physical inactivity, theoretically supported protective resources, and adolescent physical activity participation. Concentrating nursing research and ensuing interventional efforts toward

physical activity participation will improve premature death rates, healthcare expenditures, and health disparities, as adolescents progress through adulthood (Richards, et al., 2009; WHO, 2011e).

Adolescent physical activity participation. Physical activity is a contextual, health-promoting strategy that acts to counter sedentary behaviors and inactivity and has the potential to prevent chronic disease. Undergirding this health-promotion approach is the considerable body of research associating physical activity with physiological and psychological health-benefits, across the lifespan (Teague et al., 2007; WHO, 2011c; Yap, Hemmings, & Davis, 2009). Most physiological benefits are directly linked to the frequency (how often), duration (how long), and intensity (how vigorous) of the physical activity performed (Delisle, Werch, Wong, Bian, & Weiler, 2010); however, any type or amount of physical activity provides important health benefits when compared to a sedentary lifestyle (American Heart Association, 2012; USDHHS, 1996).

Peak bone mass is reached in adolescence; therefore, achieving optimal physical activity levels throughout childhood and adolescence is advantageous in preventing osteoporosis during later adulthood (CDC, 2012a; WHO, 2011b). Other positive outcomes of physical activity include controlling or improving body weight, improving sport performance and sleep, increasing high density lipoprotein values, and improving muscle strength, balance, and coordination (Teague et al., 2007). Physical activity has also been associated with improved psychosocial functions such as mood elevation and prevention of depression and anxiety (CDC, 2012a).

Despite the number of health-promotion and disease prevention benefits, the level of participation in physical activity steadily declines through adolescence, especially in girls (CDC, 2012c). Data suggest that only 18.4% of high school adolescents in the US engage in regular physical activity seven days per week while 37% report regular physical activity five days per week (Eaton et al., 2010). Twenty-three percent of adolescents in grades 9-12 report they did not participate in physical activity for at least 60 minutes on any day of the week (CDC, 2013). Adolescents spend a great deal of time inactive, while engaged in activities such as watching television and playing computer games, which are correlated with obesity in youth (Biddle, Pearson, Ross, & Braithwaite, 2010; Rosenberg et al., 2010). Adolescence is a pivotal and important time to establish regular physical activity as a lifestyle habit. Physical activity data were collected during the LongHerby study when participants were in Grade 8 and the DHBMA study when participants were in Grade 9.

Risk Factors

Body mass index. Body mass index (BMI) is a universal indicator used for determining underweight, normal weight, overweight, and obesity in adolescents. Height and weight are simple, non-invasive, and reliable measures used to calculate the BMI, which is reported in percentiles for age and sex. Health-risks are stratified according to BMI with higher values placing adolescents at a higher risk for developing obesity-associated chronic diseases. The Institute of Medicine adopted the terms associated with the health-risk percentiles to indicate the seriousness of high percentage values and the urgent medical nature the higher values represent (Barlow & The Expert Committee,

2007). The designation of childhood obesity includes children who are either overweight with a BMI in the 85th to 94th percentile or obese with a BMI value > the 95th percentile (Barlow & The Expert Committee, 2007).

Individual BMI values are used for epidemiologic surveillance and health-risk screening. Surveillance data are often collected in aggregate, and then classified by sex, race, and ethnicity, to provide general population information. Accurate measurement of height and weight requires a standardized measurement protocol, adequate training of data collectors, and quality equipment. It is not always feasible to conduct direct anthropometric measurements and some study designs include data collection performed by mail, telephone, and written surveys. Self-reported height and weight data are acceptable alternatives to retrieve data needed for BMI percentile computation with the understanding that self-reports often reflect some measurement bias toward a lower BMI percentile than a standardized measurement reading (Himes, 2009). Cultural sensitivity is presumed by healthcare providers when communicating BMI percentile values and classifications to adolescents and their care providers, as Hispanic and African American adolescents often underestimate their weight status (Dietz, Story, & Leviton, 2009; Krauss, Powell, & Wada, 2012). Self-reported BMI percentile data were collected during the LongHerby study when participants were in Grade 8.

Media use. Adolescents, regardless of age, sex, race, or ethnicity, typically find sedentary activities such as playing video games, leisure time computer use, and television viewing (media use) enjoyable discretionary-time activities (Dietz & Gortmaker, 2001; Marshall, Gorely, & Biddle, 2006). Physical and sedentary activities

are polar opposites in terms of individual physiological energy balance and their subsequent impact on health benefits and outcomes. Television viewing and computer use, generally grouped and expressed as screen time, are the most common sedentary pastimes for adolescents. Adolescents' often favor screen time over opportunities to participate in physical activity. Video game playing is a popular adolescent sedentary interest as well, and this is referred to as media-based sedentary behavior (Marshall et al., 2006; Santos, Gomes, & Mota, 2005). Reading, talking on the phone, and listening to music are other discretionary time, proxy measures of adolescent sedentary practices. All modalities of sedentary pursuit are potentially modifiable behaviors that may decrease as time is spent in physical activities. Increasing discretionary time in physical activity can counter the physiologic energy surplus, common among adolescents.

Sedentary behaviors, such as media use, contribute to the mushrooming adolescent obesity epidemic. In their seminal study, Dietz and Gortmaker (1985) found that for each additional hour per day that adolescents watched television, the prevalence of obesity was 2% higher. Current CDC data reveal that adolescent screen time continues to be a concern (HealthyPeople.gov, 2012). Tracking over a 10-year period (1999-2009) revealed that 24.9% of American adolescents engaged in leisure time computer use while 32.8% of American adolescents engaged in leisure time television viewing, both for more than three hours per day. These data reflect a 10% improvement in television viewing from the previous survey, but still above the established goal (CDC, 2010d). Media use data were collected during the DHBMA study when participants were in Grade 9.

Parental activity. Parents play a significant role in the development of adolescent physical activity behaviors and establishing family activity standards (Williams & Mummery, 2011). Parental modeling of physical activity is the foremost influence in shaping adolescent values, enjoyment, and engagement in physical activity (Berge, Arikian, Doherty, & Neumark-Sztainer, 2012; Kubik, Lytle, & Fulkerson, 2005; Weiss, 2000). Parents who model a consistent physically active lifestyle contribute to adolescent establishment of positive attitudes and motivation toward participation in physical activity (Kahn et al., 2008). McDavid, Cox, and Amorose (2012) found that physically active mothers and fathers both significantly influenced adolescent motivation to engage in leisure time physical activity. In contrast, Terzian and Moore (2009) found that physically inactive adolescents had parents that did not model routine physical activity for health benefits, or leisure time physical activity. Parental activity data were collected from the parents during the DHBMA study when participants were in Grade 9.

Protective Factors

Ethnic identity. Formation of ethnic identity (EI) is a salient and normative construct of personal identity formation for adolescents. This aspect of adolescent identity development is related to one's membership in an ethnic group (Greig, 2003) and matures progressively, like other developmental milestones. EI is achieved directly as a developmental task and indirectly through interaction with sociocultural influences, within the context of the family, school, and neighborhood influences (Chao & Otsuki-Clutter, 2011). Achievement of EI is essential for positive and holistic psychological

development in minority adolescents (Greig, 2003; Huang & Stormshak, 2011; Phinney, 1992; Phinney & Ong, 2007).

A strong sense of EI is associated with psychological well-being and operates in a protective role against health risks by promoting positive outcomes, via moderating interactions (Chao & Otsuki-Clutter, 2011; Greig, 2003; Love et al., 2006; Umana-Taylor, Gonzales-Backen, & Guimond, 2009). Research evidence that directly associates the achievement of EI with health-promoting behaviors among adolescents is inadequate. No studies have been identified that examine the association of EI with physical activity participation or explore EI as an interaction variable to promote adolescent health behavior. The literature overwhelmingly supports adolescent EI as a moderator of adolescent risk behaviors (Love et al., 2006; Nasim et al., 2007) and harmful outcomes and for this reason EI was proposed to moderate risk factors for adolescent physical activity. Ethnic identity data were collected during the DHBMA study when participants were in Grade 9.

Health awareness. Autonomous health-promotion and health-protective behaviors are positive outcomes of adolescent health awareness. Forty-three million or 13.8% of the American population fall within the classification of adolescence (U.S. Census Bureau, 2011) and there have been 30 years of organized governmental initiatives aimed toward improving and maintaining the health of adolescents. Without precedence, 21st century adolescents have grown up in a web-connected world that presents an abundant amount of health-related information; information that influences their health-related knowledge, skills, and attitudes. Adolescents may be active consumers or passive

recipients of health information that is accessible in their homes, schools, and community settings, and through diverse modes. Adolescents may seek or receive health information through interpersonal communication with adults and peers, printed materials at a health clinic, Internet searches, mass-media reports or advertisements, and on social networking sites. Adolescent use of mass media to acquire health information differs between males and females, Black and White races, and urban and rural settings. Lariscy, Reber, and Paek (2010) found that girls use broadcast media such as the radio, rural adolescents use online sources, and African American adolescents use a combination of radio and online sources to gather and learn health information. Nursing research lacks depth regarding adolescent health awareness, especially regarding Hispanics, and that creates a breach in our objective understanding about the moderating potential of this protective resource, toward health-risk behaviors. Health awareness data were collected during the DHBMA study when participants were in Grade 9.

Social connectedness. Social connectedness between caring adults and adolescents is a keystone in the development of resilient adolescents and is critical to adolescent social development (Bernat & Resnick, 2009). From birth, individuals are biologically primed to connect with people and this early attachment within a family unit is where social connectedness is born (Karcher, 2001). As adolescents grow and develop, connectedness becomes more diversified across the adolescent social ecology, as nurturing and caring relationships are formed, outside the parental connection (Karcher, 2001; Resnick, Harris, & Blum, 1993). Adolescents who perceive a sense of connectedness within their school and community environments are less likely to engage

in health-risk behaviors (Bernat & Resnick, 2009). Across socio-demographic gradients, Youngblade et al. (2007) found a greater amount of health-promoting behaviors among adolescents who were connected with caring neighbors than those who were not. When compared to African Americans and Latinos, Karcher and Sass (2010) found that Caucasians were significantly more connected to the neighborhood and friends than with their siblings, while girls were significantly more connected to friends, siblings, school, peers, and teachers than males. They found no sex differences in connection with parents. Social connectedness data were collected during the DHBMA study when participants were in Grade 9.

Research Questions

The overarching aim of this study is to further describe the dynamics that underpin adolescent participation in physical activity. The following research questions were addressed. Among adolescents who participated in a cohort-sequential longitudinal study:

1. What are the sex, racial, and ethnic differences in body mass index percentile (BMI) when the participants were in Grade 8?
2. What are the sex, racial, and ethnic differences in physical activity, when the participants were in Grade 8?
3. What are the sex, racial, and ethnic differences in risk factors (i.e., media use and parental physical inactivity) when the participants were in Grade 9?

4. What are the sex, racial, and ethnic differences in protective resources (i.e., ethnic identity, health awareness, and social connectedness) when the participants were in Grade 9?
5. What are the sex, racial, and ethnic differences in physical activity participation when the participants were in Grade 9?
6. What is the nature of the relationships among the BMI percentile (measured in Grade 8), physical activity participation (measured in Grade 8), and physical activity participation when the participants were in Grade 9?
7. Does the BMI percentile (measured in Grade 8) predict physical activity participation, when the participants were in Grade 9?
8. Does physical activity (measured in Grade 8) predict physical activity participation when the participants were in Grade 9?
9. What is the nature of the relationships among the risk factors, the protective resources, and physical activity participation when the participants were in Grade 9?
10. Do the protective resources moderate the effect of the risk factors on physical activity participation when the participants were in Grade 9?

Theoretical Definitions

Theoretical definitions to be used in this study are as follows:

- Sex: Participants' self-identification as female or male
- Minority race: Participant's self-identification as any race except single-race white (census.gov, 2012)

- Ethnicity: Participant's self-identification as Hispanic or Latino and Non-Hispanic
- A risk factor is a characteristic (variable) of the individual or environment that is related to an increased probability of a negative outcome (Compas & Reeslund, 2009). Factors in this study that were examined as risks for adolescent physical inactivity, and are not amenable to enhancement or change include female sex, minority race, and Hispanic ethnicity. Factors in this study that were examined as risks for adolescent physical inactivity, and are amenable to enhancement or change with education and health-promotion initiatives include high levels of BMI, media use, and parental activity.
- Body mass index: the universal indicator used for describing underweight, healthy weight, overweight, and obesity. The value is calculated from the adolescent's height and weight and is plotted on an age and sex specific growth chart to obtain a percentile ranking.
- Media use: a range of sedentary activities that adolescents participate in such as using computers, television, playing video games, and reading.
- Parental activity: Parents who do not exercise vigorously or engage in any leisure-time physical activity.
- A protective resource is an aspect of the individual, environment, situation, or event that tempers risk factors, and is associated with positive or resilient outcomes (Compas & Reeslund, 2009; Fergus & Zimmerman, 2005). Factors in this study that were examined as protective resources for adolescent physical activity and that are amenable to enhancement or change with education and

health-promotion initiatives include a high sense of ethnic identity, health awareness, and social connectedness.

- Ethnic identity: an aspect of identity development that is related to one's membership in an ethnic group and results in how individuals view themselves relative to the ethnic group (Greig, 2003).
- Health awareness: the adolescent's increasing knowledge and perception of personal health status, through education and consultation with others (Gillis, 1997).
- Social connectedness: the adolescent's sense of belonging and engaging in meaningful relationships with caring adults, is a critical resource in protecting adolescents from poor developmental and health-outcomes (Henrich, Brookmeyer, & Shahar, 2005; Resnick et al., 1993).
- Physical activity: any bodily movement produced by the contraction of skeletal muscle that increases energy expenditure above a basal level, and enhances health (CDC, 2012d).
- Physical activity participation: a range of activities that includes play, games, sports, transportation, chores, recreation, physical education, or planned exercise (WHO, 2011b).
- Adolescence: encompasses the ages from puberty to adulthood and is divided into three stages (American Academy of Pediatricians, 2011). Early adolescents (ages 11 to 14 years; Grade 8) and middle adolescents (ages 15 to 17 years; Grade 9) were examined.

Assumptions

1. The adolescents in Central Texas follow similar national patterns of physical activity:
    a. Physical activity participation declines with age (CDC, 2010a).
    b. Physical activity participation is higher in Caucasians and males (CDC, 2010b) than Hispanics, African Americans, and females.
2. The adolescents have the cognitive ability to self-report data.
3. The adolescents are truthful in their responses to the surveys.
4. The adolescent growth and development trajectory is normative.

Limitations

1. Non-probability sampling is not representative of the general regional race and ethnicity population.
2. The sample may not equally stratify adolescents by sex, race, or ethnicity.
3. The data were self-reported and answers may be subject to recall bias or social desirability.
4. The design of the study limits inferences about cause and effect relationships among the risk and protective factors and physical activity.
5. Use of an extant database in a secondary analysis limits the precision with which research questions can be posed.
6. Use of an extant database in a secondary analysis limits the actual questions that can be asked.

Summary

Across settings, scientists are increasingly using evidence to inform all stakeholders about ways to apply science toward the goal of ensuring positive development in today's youth (Damon & Lerner, 2008). Adolescence is a time in life when health education, health-promotion behavior enhancement, and primary or secondary preventive care can have the greatest impact on the overall future health of America by establishing health-promoting lifestyles and behaviors. Adolescence is a unique and transitional phase in life marked by rapid developmental changes, in every dimension of health. Physical activity is a health-protective factor and a health-enhancing behavior. Adolescent physical activity patterns, correlates, and determinates need to be more fully understood in order to curb current morbidity rates that are associated with sedentary and physically inactive behaviors. Describing the association between risk factors and protective resources, within an ethnically diverse group of adolescents furthers our understanding of when and how to intervene to promote physical activity participation and improve health-outcomes in similar groups of adolescents. It is imperative that teens acquire the skills to maintain a healthy weight, despite their enjoyment of sedentary behaviors; this can be accomplished through enhancing factors that buffer the significant amount of risk they face. The findings of this study will assist nurses, health educators, and public health program planners in their endeavor to improve adolescent physical activity participation, and thereby reduce the risk for obesity and its chronic sequelae through adulthood.

CHAPTER II: REVIEW OF LITERATURE

In this chapter, the principal investigator presents a review of literature related to the factors that have positive and negative effects on male and female adolescent participation in physical activity. The research described in this chapter provides background information supporting the importance of conducting this investigation. The chapter begins with a review of adolescent development as a point of reference for the remainder of the chapter topics. A review of the childhood obesity literature is followed by an overview of resilience theory, as related to adolescent research. Then, an extensive review of the physical activity literature is found. Closing the chapter is a review of the risk factor and protective resource variables, principal to this study. A summary of the literature review follows the discussion.

Development of Physical Activity

Physical activity begins at birth and progresses through the normative infant milestones of turning, crawling, and walking. Concurrently, neuromuscular development and control occur and more complex activity skills ensue. Basic movement patterns of throwing, catching, and balance become established during the pre-school years and set the stage for a broad range of physical activities along the life spectrum. With normal development, basic movements mature during the elementary school years and by adolescence their basic movement skills are proficient and coordinated. The integration of basic movement, manipulation, locomotion, and stability skills develop into the more complex movements necessary for individual, and group activity endeavors of adolescents (Lubans, Morgan, Cliff, Barnett, & Okely, 2010) such as running, dance, and

organized sports (Okely, Booth, & Patterson, 2001b). Teens place value in the activities in which they excel and use these experiences to formulate physical self-perception and physical self-concept that reinforce regular participation in physical activities (Daley & Leahy, 2003; Kuhn & Franklin, 2008).

Adolescent Development and Developmental Influences on Physical Activity Participation

Adolescence is a passage from childhood to adulthood and is divided into three stages (American Academy of Pediatrics, 2011). Early adolescence comprises ages 11 to 14, middle adolescence ages 15 to 17, and late adolescence is recognized as 18 to 21 years of age. Adolescence is a process of transition, marked by rapid growth and change, most especially noted in the physical, psychological, social, and cognitive dimensions of health (Hales, 2004). Adolescence is a process, with distinct milestones being reached within a range of six to ten years, sometimes longer, as each child has an individual trajectory into young adult maturity (American Academy of Pediatrics, 2012). All developmental components coalesce in the later stage of adolescence (Arnett, 2000; Rew, 2005). A positive developmental trajectory during adolescence lends to the emergence of a holistically, integrated young adult (Rew, 2005). Arnett (2000) describes a period in the life course between the ages of 18-25 known as emerging adulthood. It is a period during which individuals in industrialized countries continue to explore their identity through life experiences while continued cognitive development and independence influence autonomous worldviews.

Psychosocial Tasks

In his work, *The Eight Ages of Man,* Erikson (1966) described the psychosocial crisis of adolescence as identity versus role confusion that builds upon previous normative and positive psychosocial development. While dealing with the physiological revolution that occurs in adolescence, adolescents in this stage become very concerned with how others view them in comparison to their personal feelings of who they are. The fluid developmental integration of biological and sociocultural influences culminates in the formation of ego identity. Erikson (1966) goes on to describe a moratorium where adolescents may prolong the search for identity and a complete sense of self while clarifying social values and determining a career direction. In his study of 86 college enrolled males, Marcia (1966) described the moratorium as a point where the adolescent is actively experiencing the psychosocial crisis described by Erikson. In the moratorium phase of identity development the participants demonstrated vague commitments and an inner struggle toward young adult occupation and ideology (Marcia, 1966).

Identity development occurs concurrently with other developmental milestones such as abstract thinking, decision making, and corporal growth. During this moratorium segue to young adulthood, adolescents may continue to experience health vulnerabilities related to health risk behaviors. This study aimed to describe and explain protective resources and moderating interactions useful to developing future research that incorporates strategies to increase physical activity participation in adolescents.

Physical Development

During the adolescent years, youths experience many physical changes in their bodies. The process of physical growth and maturation, along with puberty and sexual maturation, are regulated by genetic and environmental variables (Hills & Byrne, 2011). Overall, both males and females experience growth in height and muscle mass, and continue to refine motor skills consistent with their genetic potential (Hills et al., 2007). Maturational changes in bone, muscle, and fat are the more important aspects of adolescent physical growth (Bates, 1995). Physical activity benefits corporal growth in terms of increasing bone mineral density, strengthening skeletal development, and regulating body composition within a normal range (Hills & Byrne, 2010). Bone mass is completed, with approximately one-half achieved in adolescence (Hills et al., 2007). Physical development is a consistent and gradual process; however, the age of emergence of a more adult-like body fluctuates greatly among adolescents (Bates, 1995).

Puberty

The quintessential pubertal growth spurt is a landmark of adolescence. Pubertal hormone production stimulates genital maturity and the secondary sex characteristics, such as female breast buds and male testicle enlargement, emerge. Additionally, puberty initiates hair growth in the pubic and armpit regions in both boys and girls. Puberty occurs in the adolescent age range of 11-16 years of age (Bates, 1995). Although normative for adolescents to sometimes judge themselves against others at different physical or sexual developmental stages, the practice can lead to feelings of inadequacy in competence, body satisfaction, and self-worth and negatively influence participation in

physical activities (Blyth, Simmons, & Zakin, 1985; Bornholt & Piccolo, 2005; Duncan, Ritter, Dornbusch, Gross, & Carlsmith, 1985). Non-Hispanic White girls who experienced early pubertal maturation developed feelings of depression, low self-worth, and weight fears that lead to diminished participation in moderate-to-vigorous level physical activity (Davison, Werder, Trost, Baker, & Birch, 2007). According to Duncan, Duncan, Strycker, and Chaumeton (2007), early physical maturation was a significant predictor for participation in physical activities for boys while in early adolescence. However, early maturation was also associated with a greater decrease in physical activity as they transitioned through subsequent adolescent stages, suggesting that early maturing boys may need additional intervention to sustain physical activity as a lifestyle behavior.

Self-Concept

Several aspects of personal identity develop during adolescence. As self-concept and body image further differentiate and develop, adolescents experience a growing sense of efficacy and competence. Adolescents begin to explore their individual personal identity, and separate from their parents or primary care givers. Together with social experiences and maturing cognitive processes (self-reflection and abstract thinking), adolescents cultivate a sense of mastery and develop a stable sense of self (Adams, 1977; Pelligrino, 1980). Colchico, Zybert, and Basch (2000) asserted that positive self-perceptions are correlated with adolescent participation in and adherence to regular physical activity. In turn, physical activity experiences foster a positive self-concept and psychological well-being (Covey & Feltz, 1991). Further, Bornholt and Piccolo (2005)

proposed that a healthy self-concept is a major component in motivation to participate in physical activity that endures through adulthood.

Social Development

Socially, adolescents begin to interact differently within the context of family and friends. Adolescent reasoning is strengthened; therefore, adolescents begin to question the legitimacy of parental authority over personal choice (Collins & Steinberg, 2008). As adolescents begin to form independence from their parents, they form important bonds within peer groups. These peer alliances beget companionship, loyalty, and influential support that either buffer health-risk factors (Hill & Lissau, 2002) or lead to health-risk behaviors. High school students reporting a strong support system practice healthier behaviors (Callaghan, 2006). Further, Vorhees et al. (2005) related that social support provides protective effects for engaging in physical activity. Extra-curricular activities offer adolescents an opportunity for informal social interactions and development of social confidence, leading to social competence (Daley & Leahy, 2003). Discernment of how and when social influences impact adolescent health decisions and behaviors provide health promotion opportunities to improve adolescent participation in physical activity, while potentially reducing the burden of chronic disease, across the lifespan.

Brain and Cognitive Development

Brain development is transformed both structurally and in functional efficiency (Luciana, 2010) during adolescence. Physiologic brain development plays an essential role in physical activity behaviors being adopted from adolescence into adulthood, as neuronal sculpting occurs and connections are strengthened into adulthood. Adolescent

activities and experiences guide the neuronal pruning (Kuhn & Franklin, 2008). The human brain continues to develop into the third decade of life, rendering the risks and vulnerabilities experienced during adolescence to persist in emerging adulthood (Sebastian, Viding, Williams, & Blakemore, 2010; Silveri, 2012). Neuron myelination, maturation of the pre-frontal cortex, and cognitive development continues into the mid-20s. The pre-frontal cortex is responsible for critical and logical thinking (Steinberg, 2011) that supports adolescent engagement in health-behaviors and practices.

Adolescent cognitive beliefs are positively related to healthy lifestyle behaviors (Melnyk et al., 2009). Academically, healthier students make better learners (Fetro, 2010), which impacts translation of health knowledge into positive behavioral health practices. Adolescents gain autonomy in their thinking and ideas, as cognition develops. The primary novelty in this area of development is formal operational thought processes (Piaget, 2008). Using formal operations, adolescents learn to reason, correlate, problem solve, and make logical inferences about relationships among objects, people, and categories (Kuhn & Franklin, 2008). At this point, adolescents can critically consider their actions and formulate alternative actions if necessary. Seeking independence from parental ideas and advice (Collins & Steinberg, 2008), behavioral autonomy emerges, and is an important marker for adult health behavior.

Personal Agency

Built upon an individual's self-efficacy, adolescent personal agency emerges, matures, and is defined as the ability to exercise control over one's health behaviors. To be an agent for one's self is to intentionally make things happen by one's own actions

(Bandura, 2001). Intention is the cognition necessary to plan behaviors, such as physical activity (Dombrowski & Luszczynska, 2008). Bandura (2001) proposed that through agency people use their cognitive abilities to plan, implement, and evaluate actions that have a valued outcome to them. Self-efficacy leads to a greater involvement in physical activity behaviors (Elder et al., 2007). Personal agency, along with a positive sense of competence, promotes adolescent understanding that they have health choices, can exert control over those choices, and can make changes in their physical activity behaviors to enhance their health (Contento, Kock, Lee, Sauberli, & Calavbrese-Barton, 2007). Dombrowski and Luszczynska (2008) found that adolescent physical activity is predicted by implementation of a conscious self-regulatory process rather than an automatic process, as in childhood. In the sense of overall positive adolescent development, consistent participation in physical activity is paramount.

Adolescent Obesity

The CDC (2011a) uses the term childhood obesity to refer to children and adolescents between the ages of 2-19 years, who are overweight or obese. Children are considered overweight when the BMI reaches and ranges between the 85th to 94th percentile for sex and age, and obese when the BMI reaches the 95th percentile and above, for sex and age. Escalating obesity trends have been an adolescent health concern for more than three decades (Steele, Nelson, & Jelalian, 2008) and remain a precept for adolescent health promotion initiatives. The earliest obesity related research was published over 40 years ago. Researchers continue to disseminate information about the

harmful outcomes of obesity. The evidence demonstrates there has been little progress made in curbing the epidemic and clearly supports the necessity for this study.

Trends

Adolescence is a period of high risk for the development of obesity that persists into adulthood (Dietz, 1994). Prevalence rates have more than tripled since the 1960s (Ogden, Carroll, Curtin, Lamb, & Flegal, 2010; Troiano & Flegal 1998). Ogden et al. (2010) reported that an estimated 34% of children were either overweight (16%) or obese (18%). The 2009 Youth Risk Behavior Surveillance (YRBSS) data indicated that 12.0% of the nation's high school students were obese (Eaton et al., 2010), which demonstrates a slight improvement from the 2007 YRBSS surveillance of 13% (Eaton et al., 2008). The percentage of overweight adolescents remained constant at 16% in 2009, compared to 2007 when 15.8% of high school students were overweight (Eaton et al., 2010; Eaton et al., 2008). There is a 25-50% probability that adolescent obesity will persist into adulthood (Garn, 1985). Must, Jacques, Dallal, Bajema, and Dietz (1992) conducted a 55-year follow-up with the adolescent participants in the Harvard Growth Study of 1922, and found that childhood overweight and obesity were a stronger predictor of obesity related morbidities and mortality in adulthood, than adult onset obesity.

Adolescent weight gain develops slowly as a result of small positive increments in energy balance and is related to a precipitous, age related decline in physical activity (Butte, Puyau, Adolph, Vohra, & Zakeri, 2007; Fulton et al., 2009; Gordon-Larsen et al., 2004). Generally, quantifying individual daily energy intake and expenditure lacks accuracy (Rennie, Johnson, & Jebb, 2005). However, in reviewing 20 prospective

studies, Must and Tybor (2005) found that higher levels of physical activity reduced the likelihood of adolescent weight gain, over time. Adolescents aged 18-25, sometimes referred to as emerging adults (American Academy of Pediatrics, 2012; Arnett, 2000), are at particular risk of developing obesity that persists through the lifespan (Gordon-Larsen et al., 2004; Racette, Deusinger, Strube, Highstein, & Deusinger, 2005).

Reviewing physical activity participation of college age adolescents is disconcerting as there is a precipitous decline in physical activity participation with age. In the United States, 43% of adolescents aged 18-25 are enrolled in college (U.S. Census Bureau, 2010). Irwin (2007) and Sarkin, Nichols, Sallis, and Calfas (1998) found that only 35% of college students in Canada and 37% of college students in Southern California kept physical activity levels sufficient to maintain a physiologic energy balance that results in health benefits. Similar findings were replicated in college students from three major universities in North Carolina (Desai, Miller, Staples, and Bravender, 2008). Desai et al. (2008) found that complete physical inactivity rates ranged from 37% in normal weight college students, to almost 50% in overweight college students.

In their longitudinal study, McTigue, Garrett, and Popkin (2002) discovered that male and female White, Hispanic, and African Americans had a substantial incidence of obesity at age 20-22 years. Further, McTigue et al. identified that participants with a significant incidence of obesity by age 35-37 were obese during childhood and as they emerged into adulthood. All racial and ethnic groups were affected. Moreover, females were at double risk for obesity by the age of 35 (McTigue et al., 2002). Butte et al. (2007) found that the prevalence of sedentary activities in 4-19 year olds were significantly

higher in obese children. Low levels of physical activity coupled with upward age-related increases in sedentary activities are foreboding, and underscore the necessity to increase physical activity participation in adolescents as a strategy to prevent further incidence of adolescent obesity.

Physical Outcomes

Obesity has a profound effect on all body systems and results in numerous adverse physiological and psychosocial health consequences (Must & Strauss, 1999; Steele et al., 2008). The metabolic changes associated with obesity often emerge during childhood, and frequently, are silent for decades (Must et al., 1992; Must & Strauss, 1999; Serdula et al., 1993). Studies conducted over the past three decades reflect the burden of disease associated with childhood obesity as it persists in adulthood. Obese children have an increased risk for insulin resistance and type 2 diabetes mellitus, sleep apnea, arthritis, gallstones, fatty liver and cirrhosis, menstrual abnormalities, and cancer (Crawford, & Osler, 1975; Friesen & Roberts, 1989; Honore, 1980; Mallory, Fiser, & Jackson, 1989; Must & Strauss, 1999; Richards et al., 1985; Srinivasan, Bao, Wattigney, & Berenson,1996; Steenbergen, & Lanckmans, 1995; Tominaga et al., 1995; WHO, 2012). Sustained obesity through the lifespan becomes an additional risk factor for adult morbidity and mortality (Maffeis & Tato, 2001). Alarmingly, obesity can have a recursive cycle. Children who are overweight are at risk to be obese adults, who in turn, are at risk to raise obese children (McTigue et al., 2002).

A well-known sequelae resulting from childhood obesity is cardiovascular disease. Prospective data showed that obese boys and girls are 8.5-10 times more likely to

develop hypertension than young adults or lean, non-obese children and adolescents (Lauer, Clarke, & Beaglehole, 1984; Srinivasan et al., 1996). Obesity, particularly in adolescent-aged males, is associated with higher than normal levels of total cholesterol (TC) and low-density lipoproteins and low levels of high-density lipoproteins, in adulthood (Laur, Lee, & Clarke, 1988; Srinivasan et al., 1996). Frerichs, Webber, Srinivasan, and Berenson (1978) found that the association between high TC, abnormal lipoprotein levels, and the degree of childhood obesity was strongest among male participants. Adolescent hypertension, high levels of TC, elevated low density lipoproteins, and low levels of high density lipoproteins are cardiovascular risk factors associated with an increased chance of adults developing other obesity-related morbidities. Persistent obesity emerging into and throughout adulthood is in itself an independent risk factor for cardiovascular disease, as well as type 2 diabetes mellitus, hyperlipidemia, gall bladder disease, osteoarthritis, and cancer in adults (Burton, Foster, Hirsch, & Van Itallie, 1985).

Psychosocial Outcomes

The psychosocial implications of obesity may significantly influence adolescent development (Must & Strauss, 1999). In the 21st century, body image dissatisfaction, low self-esteem, depression, dietary restraint, peer relations, and lower academic achievement are lasting themes in adolescent obesity research (Florin, Shults, & Stettler, 2011; Goldfield et al., 2010; Strauss & Pollack, 2003; Wang & Vuegelers, 2008). Early evidence suggested that body image disturbance and low self-esteem were associated with obesity during the adolescent years (Monello & Mayer, 1963; Sallade, 1973;

Stunkard & Burt, 1967). In addition, fear of fatness with associated caloric restrictions led to eating disorders in adolescent girls (Patton, Johnson-Sabine, Wood, Mann, & Wakeling, 1990; Pugliese, Lifshitz, Grad, Fort, & Marks-Katz, 1983).

Obesity-associated depression continues to be the most common psychological research topic in the adolescent obesity literature (Erickson, Robinson, Haydel, & Killen, 2000; Janicke et al., 2007). Baum and Forehand (1984) found that overweight or obese early stage adolescents were subject to negative peer interactions and stereotyping. Peer intolerance of the physical appearance of overweight and obese children may have a profound negative developmental outcome in adolescence, which transfers to negative social adjustment in adulthood. Other common psychosocial manifestations noted in obese adolescents include negative self-concept, low self-esteem, social stigma and discrimination, peer victimization, a generally lower quality of life, and suicidal ideation or attempt (Eaton, Lowry, Brener, Galuska, & Crosby, 2005; Janicke et al., 2007; Meyers, Raynor, & Epstein, 1998; Puhl, Luedicke, & Heuer, 2011; Strauss, 2000; Tsiros et al., 2009). Based on the results of their pilot weight management program, Rourke, Brehm, Cassell, and Sethuraman (2003) concluded that positive self-efficacy and physical activity competence would improve the motivation of adolescent girls to participate in physical activity for health-enhancement and their future well-being. In their landmark longitudinal study, Gortmaker, Must, Perrin, Sobol, and Dietz (1993) found that childhood obesity was associated with lower academic achievement and higher rates of poverty. In addition, as the obesity persisted into adulthood, women more so than men suffered psychosocial adversity such as a lower household income. The

relationship between obesity and the subsequent social outcomes did not vary by race or ethnicity. More recently, a review of research found an indirect effect between childhood obesity and poor academic achievement via low self-esteem and lack of pursuit of higher education (James B. Hunt, Jr. Institute for Educational Leadership and Policy, 2008).

Demographics and Sociocultural Influences

Race, ethnicity, and sex differences in the incidence and prevalence of adolescent obesity are important to examine. However, it is difficult to untangle the relative impact of race and ethnicity on obesity. McTigue et al. (2002) contended that race, ethnicity, and sex are proxies for more specific factors associated with obesity such as neighborhood safety, the built environment, and parental personal or proxy agency for their children. Parental obesity is positively correlated with child obesity, but the genetic component, sociocultural context, and community ecology of that relationship need further study (Elder et al., 2010). Normal weight and overweight adolescents differ in how they perceive body size. O'Haver et al. (2011) noted that adolescent participants did not necessarily recognize overweight status as unusual. This perception may be based on the increasing overall prevalence rate of adolescent obesity. O'Haver et al. (2011) also found that early to middle stage adolescent girls and non-Caucasians were less satisfied with their actual size, feeling they were underweight compared to peers in the large, racially and ethnically diverse sample.

Examining independent and joint effects of key sociocultural and demographic risks on childhood obesity within a large nationally representative United States sample, Singh, Kogan, VanDyck, and Siahpush (2008) found that African American and Hispanic

adolescents were more likely to become obese, especially if clustered with higher poverty levels and negative environmental factors (neighborhood safety, television viewing, physical inactivity). While assessing obesity trends in adolescent females aged 12-19, Huh, Stice, Shaw, and Boutelle (2012) found that 85% of the European American, African American, and Latino participants remained obese at the one year re-assessment, indicating that obesity becomes increasingly chronic with age. Their findings showed racial and ethnic differences among the participants as well. European American girls had the lowest prevalence of obesity at age 12, but obesity as a chronic condition throughout adolescence was comparable among the European American, African American, and Hispanic girls. The interaction between ethnicity and time suggested that the incidence of obesity in the African American participants occurred later in adolescence. Analysis of data from three large, nationally representative United States databases demonstrated that Hispanic males are the sex and ethnic group at greatest risk for obesity and obesity-related complications (Stovitz, Schwimmer, Martinez, & Story, 2008). No obesity prevention studies that address male Hispanic adolescents exclusively were found.

Obesity research has generally focused on African American and Caucasian children, and to a lesser extent Mexican Americans or Latinos. National data are limited for Asian American, Pacific Islanders, and American Indian children (Simonton, 2008). No data could be located on Arab American children or adolescents. American Indian children who reside on tribal reservations are not included in the National Health and Nutrition Surveys (NHANES). Data assessing BMI percentiles in American Indian children in the Northern Plains reveal that 52.5% were overweight or obese. These

children were ages 8-12 and were in the third to fifth grades (Jollie-Trottier, Holm, & McDonald, 2009). Prevalence specific differences between male and female were not provided. McTigue et al. (2002) found that African American women and Hispanic men were at highest risk for young adult obesity and that African American males have obesity incidence occurring in the later years of young adulthood.

Healthcare Costs

The economic cost of the obesity epidemic places the future health and positive development of our nation's children in jeopardy. The fiscal impact of childhood obesity continues to unfold throughout adulthood. Subsequent to unchecked obesity is the development of associated physical and mental health morbidities and chronic diseases, which place an undue demand on healthcare spending (Daniels, 2006). Treatment of chronic disease is an economic burden. Using a nationally representative data set, Finkelstein and Trogon (2008) found that medical expenditures for adult obesity accounted for 9% of annual United States spending. Furthermore, Medicaid and Medicare monies finance almost one-half of the 90 billion dollar annual obesity expenditure in the United States.

Prevention

Primary and secondary prevention of obesity for all ages may impede further health and economic burdens. The public health agenda has shifted focus to primary prevention of overweight and obesity. Obesity associated complications are becoming ever more prevalent (McClanahan, 2009); thus, secondary and tertiary prevention efforts also remain essential. Focusing on lifestyle factors that are amenable to change and that

promote health is the key to prevention programs at all levels. This study aimed to elucidate factors that demonstrate protective effects against risk factors in order to promote adolescent participation in physical activity.

Resilience – Origin and Meaning for Adolescent Research

Resilience is an ordinary and seemingly natural human adaptation response. McElwee (2007) describes resilience as "bouncebackability" (p. 60) and with Latin origins meaning "to jump or bounce back" (p. 58). Metaphorically, resilience is similar to a plant that survives a harsh winter, or a summer drought, to proceed, thrive, and flourish. Definitions of resilience typically refer to a phenomenon of positive adaptation in spite of adversity (Garmezy, 1991; Luthar, Cicchetti, & Becker, 2000; Masten, 2001; Rutter, 1987). Sapienza and Masten (2011) recently endorsed a definition that aligns with the emerging integrative systems resilience research agenda, "The capacity of a dynamic system to withstand or recover from significant challenges that threaten its stability, viability, or development" (p. 268). Integrative systems research includes examination of the neurobiological and genetic aspects of the human adaptation response. Resilience theory and research are founded on the tenet of risk and were born from the notion that childhood risk (i.e., low IQ, poverty, maltreatment) translated to maladaptive outcomes and subsequent psychopathology. More specifically, resilience is founded within the psychopathology of schizophrenia, the psychology of coping, and the biological response to stress, that stem from a perceived or actual risk occurrence (Ahern, Ark, & Byers, 2008; Compas, 1987; Masten, Best, & Garmezy, 1990; Smith, Smoll, & Ptacek 1990).

The process is dynamic and influenced by complex interactions among developmental stage, personal traits, and environmental factors.

Scientists within the disciplines of psychiatry and psychology pioneered resilience theory research (Garmezy, 1971; Rutter, 1979; Werner & Brendtro, 2012). Focusing on prevention, Garmezy (1971) sought to understand the development of adult psychopathology in vulnerable children. Researchers began to identify individual responses to a variety of life stressors as they also studied the genetic component of vulnerability and psychopathology. Rutter (1979) built on the role of protective factors in enhancing resistance to vulnerability through interaction processes. Werner (1989) documented the pregnancies of the mothers and births and lives of 698 children born in 1955 on the Hawaiian island Kauai. The 30-year study identified that protective resources such as an engaging temperament, scholastic competence, and connection with a caring and supportive adult enhanced resilience and contributed to the healthy development of at-risk children (Werner, 1989).

Resiliency theory description and process inquiry persists and scholarly discourse about resilience is abounding. Protective factors are generally grouped into three categories (Rew & Horner, 2003): individual characteristics (i.e., temperament, health knowledge), family bonds (i.e., connection with parents, ethnicity), and community resources (i.e., friend support, built environment). Protective factors are contextual and lead to healthy outcomes based on individual and situational factors (Johnson & Wiechelt, 2004). Vulnerability is less tangible than risk or protective factors, in that it is the degree to which risk factors are associated with negative outcomes in certain

individuals. Individual vulnerability to risk is intensified during periods of life transition, such as adolescent development (Compas & Ressland, 2009). A protective model of resilience equipoises or neutralizes the risk threat, via protective factors. The study of resilience, through the lens of adaptation to risk, focuses on the positive attributes of individuals and the protective factors within their family and environment.

Initial resilience research identified that risk and protective factors are common across disciplines (Fergus & Zimmerman, 2005; Masten & Obradovic, 2006). That is not to say that there are pre-fabricated lists from which to choose these factors. The nature of resilience along with the specificity of risk and protective factors is quite a complex process. Thus, to further appreciate the breadth of the concept, collection of theoretical and empirical evidence is ongoing. Interventional study that strategically cultivates, nurtures, and fosters the factors that are projected to protect adolescents and promote positive outcomes specific to the risks encountered is underway (Hodder et al., 2011; Steinhardt & Dolbier, 2008; Valdez, Mills, Barrueco, Leis, & Riley, 2011). While resilience research remains centered on protective models, including protective interactions, a multi-system perspective of inquiry including the neurobiology and genetic underpinnings of stress and adaptation has recently been adopted (Sapienza & Masten, 2011).

Miller and McIntosh (1999) suggest that it is important to examine culturally unique protective factors, such as ethnic identity, when investigating developmental and health issues of ethnic minority adolescents. Resilience protects adolescents from risk vulnerability and the central protective mechanism is the interaction among the protective

assets or resources (Fergus & Zimmerman, 2005; Rutter, 1987) and risk factors, sometimes labeled risk correlates or variables (Compas & Reeslund, 2009). Principal to determining resilience is to establish main effects of the protective factors on the outcome or the moderating effect of protective variables on risk factors, in the context of a specific outcome (Arrington & Wilson, 2000; Fergus & Zimmerman, 2005; Luthar et al., 2000), within a cohort, prospective study. LongHerby and DHBMA were cohort, sequential databases. This study may demonstrate a positive resilience trajectory for physical activity participation. However, the study is restricted in inferring resilience because interactions between risk factors and protective resources are from a cross-section (ninth grade) of the DHBMA data only.

On the whole, promoting adolescent health is a national priority. By virtue of being an adolescent, there is great diversity in the risks and vulnerabilities encountered. Overcoming the risks and successfully navigating into young adulthood is facilitated by the guidance received from caring adults, reaching normative developmental milestones, and engaging in health promotion behaviors. An acute understanding of factors that protect adolescents along the developmental journey, to a healthy young adulthood, is important in order to build interventions that further strengthen their protection against physical inactivity and other health-risk behaviors.

Adolescent Participation in Physical Activity

Adolescents are coming into their own; setting values, attitudes, and behaviors they will hold through adulthood. As cognition matures, likewise identity and agency are emerging and are influenced by their personal social and environmental dynamisms. An

acute understanding of determinants and predictors of an active lifestyle in adolescents is important to their health. Adolescents who have strong fundamental movement skills (control over bodily movements) from childhood are more likely to be active in adolescence and subsequently throughout life (Okely, Booth, & Patterson, 2001a). Object control skills (throwing, kicking, bouncing, catching objects) lead to adolescent sports competence and are also significant predictors of adolescent physical activity (Barnett, Morgan, Beurden, & Beard, 2008). Comparing active and non-active adolescents, Santos et al. (2005) reported that active adolescents participated in significantly more moderate intensity and frequent physical activity, team sports, and organized activities. Greater than 90% of the non-active group participated in low intensity physical activity and preferred individual activities.

Benefits of Physical Activity

The benefits of physical activity are enthusiastically extolled by professionals concerned with promoting health because adolescence is a critical time to establish lifelong health-promoting behaviors (Nelson, Neumark-Stzainer, Hannan, & Sirard, 2006). Children develop a self-concept of their movement skill through self-evaluation of their physical activity experiences. Movement self-concept is more positive in boys than girls (Bornholt & Piccolo, 2005) and is antecedent to the mastery of more advanced skills leading to enjoyment of physical activity (Allison et al., 2005). Together, physical activity participation and sports competence develop an adolescent's strength and fitness, burns calories, results in a healthful appearance, increases self-confidence, and contributes to overall healthier adolescents (Barnett et al., 2008; Kahn et al., 2008).

Likewise, Delisle et al. (2010) reported that healthy youth development is enhanced by regular vigorous physical activity.

Important physiologic health effects occurring in the musculoskeletal, cardiovascular, respiratory, and endocrine systems reduce the risk of premature morbidity and mortality (USDHHS, 1996). Regular participation in physical activity results in psychosocial benefits as well, and includes improvement in depression, anxiety, and mood (Strong et al., 2005). Compared to low activity adolescents, those who engaged in a variety of physical activities demonstrated positive health-behaviors and were less likely to engage in health-risk behaviors (Delisle et al., 2010; Nelson & Gordon-Larsen, 2006), such as binge drinking, smoking, marijuana use, and poor diet (Kahn et al., 2008).

Demographic Influences on Physical Activity

Minority youth and youth from low socio-economic background are at a higher risk for low levels of physical activity (Heitzler et al., 2010). Using self-report activity measures, non-Hispanic White youth were found to be more active than African American youth, who were more active than Hispanic adolescents (Lutfiyaa, Garcia, Dankwa, Young, & Lipsky, 2008). A cross-section of NHANES data examined by Belcher et al. (2010) found non-Hispanic White males spent less time in moderate and vigorous physical activity compared to non-Hispanic Black and Mexican American males. Using an objective measure for physical activity, non-Hispanic Black youth engaged in more physical activity than non-Hispanic White youth by eight minutes per day (Belcher et al., 2010). Although very little is known about physical activity practices among Native Americans, Coble and Rhodes (2006) conducted a literature review and

found that age, sex, and social support are consistent correlates for physical activity and that Native American physical activity levels are lower than in non-minorities.

Participation in physical activities declines with age, for all races and ethnicities (Butte et al., 2007; Coble & Rhodes, 2006; Gordon-Larsen et al., 2004; Marshall, Gorely, & Biddle, 2006; Sallis, 2000). The most remarkable period of decline occurs with the initiation of puberty (Belcher et al., 2010; Dietz, 1996), between the ages of 13-16 (Kahn et al., 2008; Marshall et al., 2006). Adolescent boys are more active than girls (Barnett et al., 2008; Butte et al., 2007; Coble & Rhodes, 2006; Santos et al., 2005). A positive perception of sports competence in adolescence is a key predictor for participation in physical activity. Barnett et al. (2008) found that boys scored higher on perceived sport competence and physical activity level than girls. Decline in physical activity participation occurs more quickly in girls (Nelson et al., 2006), with activity levels consistently diminishing through the college years (Buckworth & Nigg, 2004), as they transition into adulthood (Coble & Rhodes, 2006).

Physical Inactivity

Despite the overwhelming evidence of the healthful benefits of regular physical activity, nationally representative statistics of adolescent physical inactivity cause immense concern. Only 18.4% of American adolescents meet established daily standards for physical activity. That is, 81.6% were not physically active for at least 60 minutes per day on all 7 days. Twice as many (37%) were active for at least 60 minutes per day on five days per week (Eaton et al., 2010). Lutfiyaa et al. (2008) found that obese children and adolescents aged 5-18 were the least likely group to achieve moderate levels of

physical activity while the majority of inactive adolescents are older girls (Terzian & Moore, 2009).

Lending to the predisposition toward female adolescent inactivity, Weiss (2000) reported that girls have lower perceived physical competence and a less positive attitude toward physical activity than boys. Girls transitioning from early to middle adolescence spend approximately 44% of leisure time in sedentary pursuits (Hardy, Bass, & Booth, 2007). Overall, American adolescents are considered sedentary with 5% of the total adolescent population being physically inactive, meaning that they do not exercise at least 20 minutes on any day of the week. Sedentary categorization rises to 8% between the ages of 15-17 (Terzian & Moore, 2009).

Motivation and barriers. There is a large body of evidence touting social support and social interaction as motivators for physical activity in boys and girls. Peer and parental social support have been shown to play a protective role against the normal age related decline in physical activity for girls. Duncan et al. (2007) report that girls exhibit less of a decline in physical activity at baseline and over time, when they have physically active friends. In addition, there are a number of citations asserting fun or enjoyment as motivation for adolescents to engage in discretionary physical activity such as non-competition sports, activities that challenge and build physical skills, and physical appearance (Allison et al., 2005; Kubik et al., 2005). Team sports are considered fun by some male and female high school students (Kubik et al., 2005). Boys and girls join sports teams to spend time and socialize with friends and in some instances, participating in a team sport provides the opportunity to fit in with others (Allison et al., 2005). The

social environment and culturally relevant support is integral for the physical activity behaviors of Native Americans (Coble & Rhodes, 2006). Kahn et al. (2008) added that parental expression of beliefs and encouragement toward increasing physical activity influenced their children's interest and attitudes for participation in physical activity.

Obstacles to implementing, maintaining, or increasing physical activity are not uncommon for adolescents and are often recognized within studies examining the correlates and predictors of physical activity. The actual and perceived obstacles to participation in physical activity may be different between boys and girls. Physical attributes, insufficient physical skill acquisition or fitness, lack of confidence or competence, disinterest in physical activity, and competing interests have been cited by adolescents as barriers to participating in structured and unstructured physical activity (Allison et al., 2005; Kubik et al., 2005; Li et al., 2010). Male and female high school students participating in focus groups cited family and social barriers to being physically active. Proxy agency and environmental factors were most often described as obstacles to adolescent physical activity goals. Bandura (1997) describes proxy-agency as enlisting the help of others to bring about a desired outcome. For instance, when activity requires transportation or fees, parents or primary care providers become the proxy-agent and are cited by youth as a barrier to participation (Allison et al., 2005) when other resources are not available. Other potentially modifiable factors to promote adolescent physical activity are equipment acquisition, access to activities, adult support, positive role modeling, and family engagement in activity (Kubik et al., 2005; Li et al., 2010).

Community and environmental resources also present barriers to adolescent participation in physical activity. For example, a lack of recreational facilities or community programs, lack of resources through the school setting such as limited equipment, and safety concerns for discretionary time, outside activity (Kahn et al., 2008; Li et al., 2010). A lack of nearby parks or recreational facilities and a lack of transportation to desired activity are inversely associated with physical activity (Gordon-Larsen, Nelson, Page, & Popkin, 2006; Kahn et al., 2008). Additionally, parents may prioritize value on academics such as homework and grade achievement before adolescent physical activity endeavors. These factors highlight the need for an ecological perspective to include families, schools, local communities, and governmental agencies, focused on all modifiable factors to improve adolescent participation in physical activity (Li et al., 2010).

A broad range of behavioral, social, and environmental circumstances embody adolescent inactivity but the mechanisms by which to promote physical activity in adolescents are less clear. Research on adolescent physical activity continuously evolves. It is important to study the process that develops healthy physical activity habits in adolescents. Allender, Cowburn, and Foster (2006) suggested there is limited theory generation occurring, although a plethora of physical activity research findings are available. Thus, the empirical base of explanations and rationale for participation or non-participation in physical activity remains modest. Positioning adolescents to create a legacy of recurring and habitual participation in physical activity will be accomplished as risks for inactivity are eliminated and activity-promoting factors are enhanced.

Review of Modifiable Risk Factors

Body mass index – Risk or outcome? Body mass index percentile (BMI) is a universal indicator for determining overweight and obesity. The BMI percentile is calculated from the height and weight measurements of the child and is reported in percentiles for age and sex. The BMI percentile is the most precise tool available for defining childhood obesity (Reilly, 2005) as it represents body fat accurately and denotes risks for adverse health outcomes, beginning at the 85th percentile. Health-risk values are stratified by BMI percentile values. BMI in the 85th to 94th percentile is classified as overweight and BMI > 95th percentile is classified as obese (Barlow & the Expert Committee, 2007).

Obesity occurs when there is an imbalance between energy intake and energy expenditure. Childhood obesity affects 10-25% of the pediatric population in developed countries and even thin children are fatter than in the past (Reilly, 2005). An overwhelming number of studies have produced data identifying factors associated with childhood obesity, but often the factors are confounding. A deficiency of longitudinal studies explaining the precise relationship of BMI percentiles and physical activity exists. Themes that are particularly relevant to this study include the relationship of the BMI percentile with physical activity, stratified by race, ethnicity, and sex of the participant, and specifically, as a risk factor for physical inactivity.

A positive correlation between obesity and low physical activity levels in Caucasian and Latino children is documented by Butte et al. (2007). In their study of 745 K-2nd grade Hispanic children, Elder et al. (2010) found that obese children were less

active than their non-obese peers. Belcher et al. (2010) examined the 2003-2006 NHANES databases and determined that overweight and obese, non-Hispanic White and African American youth aged 6-19 years, with higher BMI percentiles spent less time in moderate to vigorous intensity physical activity than their normal weight contemporaries, whereas, obese Mexican-American youth participated in the same amount of moderate to vigorous intensity physical activity as normal weight peers. Analyzing a cross-section of data from the National Survey of Children's Health (NSCH), children aged 5-18 years, of all races and ethnicities, were deficient on recommended amounts of moderate intensity physical activity (Terzian & Moore, 2009). The incidence of deficient physical activity increased for the obese children and was highest in obese Hispanic children, aged 12-17 years. In addition, Caucasian, African American, and Hispanic children who did not participate in team sports had higher BMI percentiles. Lutfiyya et al. (2008) found that obese African American and Hispanic children demonstrated less participation in organized sports teams (43.4% each) than their obese Caucasian peers. Social, cultural, and environmental lifestyle components may lend to the high obesity risks in minority children.

The vast numbers of cross-sectional studies are not without limitations, related to measurement of physical activity, generalizability of findings, or citing causation between BMI percentiles and physical activity. Generally, there is a negative relationship between physical activity and adiposity in children (Laframboise & deGraauw, 2011). Data suggest that a higher level of physical activity reduces the likelihood of childhood and adult weight gain over time (Must & Tybor, 2005; Saris et al., 2003). Children who

are at high risk for obesity should receive prevention education aimed at increasing physical activities and reducing passive activities (Kornides, Kitsantas, Villarruel, 2011). LeMura and Maziekas (2002) add that low intensity, long-duration activity may procure the best obesity prevention outcomes.

Media use – Television, computer, gaming. Seeking to understand the risk and protective factors for physical activity Berge, Arikian, Doherty, and Neumark-Sztainer (2012) identified the importance of the family system and home environment. In their grounded hermeneutic study Black, White, Indian, and Somali families echoed the existing literature findings on parental limits for adolescent media use.

> If friends come over, that's what they want to play. It's hard to say no videogames. It's better to have no videogames in the home because the temptation is too great, especially when they're teenagers. You know, if you don't have it, they can't play it. So they have to come up with something else to do. (31-year-old father) (Berge et al., 2012, p. 127)

> Like most teenagers, it kind of sucks, you know, not having videogames and TVs in your room, but then, like, when you actually look at it and you see, like, when you call friends or something, you're, like, ''What are you guys doing today?'' ''Nothing. Sitting at home. Watching TV.'' It's, like, come on, let's go out and, like, run and play some basketball or something and not just sit in the house. (15-year-old son) (Berge et al., 2012, p. 127)

Media use is a frequent and important aspect of adolescent life. Millennial adolescents live in a media-saturated world, have multiple modes of media to pursue and are proficient at media multi-tasking. In addition, adolescents have a proclivity for inactive behaviors. Inactive behaviors refer to activities with energy expenditure levels similar to resting, with minimal body movement (Dietz, 1996). Inactive behaviors are commonly referred to as media use, discretionary-time activities, screen-time, or passive behaviors,

in the literature. General examples are watching television, playing video games, working on a computer, listening to music, and reading magazines.

Nearly all adolescents, regardless of age, sex, race, or ethnicity find playing video games, leisure time computer use, and television viewing (media use) enjoyable discretionary-time activities (Dietz & Gortmaker, 2001; Marshall et al., 2006). A strategy to promote increased physical activity in adolescents includes limiting adolescent media use to two or fewer hours per day (American Academy of Pediatrics [AAP], 2010; CDC, 2012c). Additionally, the AAP (2001) recommends removing television sets from children's bedrooms. Lutfiyya et al. (2008) and The American Academy of Child and Adolescent Psychiatry (2012) suggested that children frequently displace time doing physical activity with inactive activities (Graham, Schneider, & Cooper, 2008) that result in declines in their metabolic rates (Dietz, 1996).

Availability of cable television in the home is associated with higher levels of screen time use by adolescents and screen time has been implicated in lower levels of daily physical activity among adolescents (Carlson et al., 2010). Marshall, Biddle, Gorely, Cameron, and Murdey (2004) found a negative relationship between moderate and vigorous intensity physical activity and television viewing, among adolescent male and female participants. This relationship persists through college and the emerging adult years for females (Buckworth & Nigg, 2004). Nelson and Gordon-Larsen (2006) discovered that adolescents with higher levels of television and video viewing also engaged in illegal drug use and violence. When health-risk behaviors cluster, adolescents who engage in higher levels of media use are at higher risk and more vulnerable to

negative health outcomes (Dietz, 1996). Although not the opposite of activity, inactivity is as significant a risk for adverse health effects, as moderate and vigorous intensity physical activity are to the benefit of health.

Rapid changes in available technology create an ever-increasing need to better understand media use among adolescents. Media use varies among adolescents as demonstrated by the mixed research findings. Overall, 27% (Carlson et al., 2010) of male and female adolescents (Atkin, Gorely, Biddle, Marshall, & Cameron, 2008) watch 3-4 hours of television per day (AACAP, 2012; Rideout, Foehr, & Roberts, 2010), which exceeds current recommendations (APA, 2012; CDC, 2012c); 39% of 14 and 15 year old adolescents exceed media time recommendations (Carlson et al., 2010). By high school graduation adolescents have spent more time in media-based activities than in the classroom (AACAP, 2012) to the extent that at age 70, adolescents will each have spent 10 years in front of a television screen (Strasburger & Hogan, 2009). Marshall et al. (2006) provided conservative statistics of adolescent media use in hours per day: television 2-2.5, computer use 0.5, and video games 0.75. According to Santos et al. (2005) non-active adolescents watched significantly more television on the weekends than the participants who were considered active and used technology for recreational purposes more than 3 hours per day (Terzian & Moore, 2009). African American and Asian American males log the most hours in media use (Carlson et al., 2010; Utter, Neumark-Sztainer, Jeffery, & Story, 2003). Longitudinally, girls transitioning from early to middle adolescence experience a significant increase in media use, accounting for 33-39% of leisure time (Hardy et al., 2007). When assessing a three hour window of after-

school discretionary time activities, Atkin et al. (2008) found that boys spent more time watching television, using the computer, and playing video games than girls. Buckworth and Nigg (2004) found this adolescent media use trend extends into emerging adulthood during the college years.

Adolescents spend an average of 35-40 hours per week consuming mass media, with 28% (Marshall et al., 2006) or 1 in 4 (Carlson et al., 2010) exceeding the recommended amount of media use per day. Adolescents who consistently engage in sedentary and inactive activities over recommended amounts are at a higher risk for weight gain than active youth. Previous research has shown that the more hours children and adolescents spend watching television, the less time they spend in physical activities (Allison et al., 2005; Ballard, Gray, Reilly, & Noggle, 2009; Marshall et al., 2004; Strasburger & Hogan, 2009). Butte et al. (2007) determined that Latino boys and girls both demonstrated a significant relationship between the hours watching television and playing video games, with elevated BMI percentile scores. Anderson, Economos, and Must (2008) and Gortmaker, Must, Sobol, Peterson, and Dietz (1996) found significant relationships between media use and elevated BMI percentiles in white children. Lutfiyya et al. (2008) established that obese African American children spent more time watching television (36.4%) and in non-school related computers use (11.8%) than their obese Hispanic and Caucasian peers.

Boys in middle adolescence had a dramatic 50% increase in computer use over a five year period, totaling to 15 hours of use per week. This trend continues through college, and is inversely related to exercise and physical activity (Buckworth & Nigg,

2004). Girls in that same study increased computer use in older adolescence, but not at quite a significant magnitude (Nelson et al., 2006); however, girls' computer use also continues to increase through college (Buckworth & Nigg, 2004). Marshall et al. (2004) found a small negative relationship between computer and video games and adolescent physical activity. Applying Bandura's (1977) social learning theory, Strasburger and Hogan (2009) maintain that adolescents learn potential health risks (violence, sex, body image, eating disorders, smoking, alcohol and illicit drug use) vicariously through media use. As documented, adolescent life is saturated with media, and media use creates vulnerability toward and risk for adverse health outcomes.

The evidence is mounting that higher levels of physical activity are associated with diminished discretionary-time media use and obesity incidence (Gordon-Larsen, Adair, & Popkin, 2002). A significant inverse relationship has been reported in after school media use and higher levels of physical activity by girls (Atkin et al., 2008), while Carlson et al. (2010) found a negative relationship between physical activity and screen time among boys and girls. Playing on an organized sports team was associated with adolescents maintaining recommended amounts of media use (Carlson et al., 2010). Parents in a multi-family focus group, mostly Black and White, reported that having rules and limits about television viewing and other sedentary behaviors, or making them unavailable, was a successful strategy to improve family activity levels (Berge et al., 2012). Likewise, Nelson and Gordon-Larsen (2006) found that when parental limits were set on adolescents' viewing television, the youth regularly participated in moderate amounts of activity in school physical education classes. A consistent parental rule about

media use is a modifiable factor and can limit or deter adolescents from engaging in excessive media use (Carlson et al., 2010).

Parental activity – Modeling attitudes, values, and behaviors. Adolescent physical activity is a behavior that is influenced by a variety of individuals, environments, and social factors. Behavior modeling was introduced within the social learning theory when Bandura (1977) surmised that children could learn behaviors through imitation, by observing others. Parents are primary role models for their children and their behaviors play an important part in adolescent development (Bernat & Resnick, 2009). Parental modeling is the foremost influence in shaping children's perceptions and enjoyment of activity (Kubik et al., 2005; Weiss, 2000). More specifically, Kahn et al. (2008) found that maternal physical activity was positively associated with adolescent participation in physical activity. White, upper-class parents are more apt to engage in and model appropriate activity behaviors for their children (Heitzler et al., 2010).

Adolescents who do not exercise or participate in sports are considered low-active teens. Terzian and Moore (2009) found that low-active teens had parents that did not exercise and were more overweight. In a cross-section of data from the National Survey of Children's Health, White, African American, and Hispanic parents of children aged 5-18 years did not meet recommended guidelines for moderate intensity physical activity (Terzian & Moore, 2009). Additionally, Lutfiyya et al. (2008) found that Hispanic mothers (49.2%) and fathers (39.3%) were more inactive than the White or African American parents. American Indian physical activity patterns were studied by Thompson et al. (2001) and parents were found to be extremely supportive of their children's

activity (> 80%) but only 22% participated in regular exercise or physical activity themselves.

Parents and youth in a Minnesota multi-family focus group identified that parental modeling was a very important strategy in helping their adolescents be more active (Berge et al., 2012), as expressed by these participants:

> . . . It's, like, come on, let's go out and, like, run and play some basketball or something and not just sit in the house. Once that stuff is instilled in you by your family, it's, like, I don't know, it's, like, fun, you know, it's, like, medicine, something that you need to do on an everyday basis. (15 year old son) (p. 127)

> . . . My kids growing up saw my husband and I do physical activity from the time they can remember. When they were little children they would stand around the gym or football field while we ran laps and they sat under the bleachers when their dad played baseball and I think that really has a lot to do with establishing values. Seeing your parents do it. (47-year-old mother) (p. 128)

Nelson and Gordon-Larsen (2006) contributed to the literature when finding that one cluster of adolescents who play sports with their parent(s) also had a high frequency of other sports participation. Parents who champion a physically active lifestyle impart positive attitudes, values, and motivation to their children (Kahn et al., 2008). Heitzler et al. (2010) corroborated that value for physical activity is reflected in parental personal and discretionary time engagement in physical activity and in turn, sets the family activity standards. Modeling of and values for physical activity position the family compass toward adopting physical activity participation, as a lifestyle behavior. Physical activity reflects familial, environmental, and social components. Trost et al. (2003) asserted that modeling positive behaviors does not impact social or environmental barriers to physical activity, but suggests that modeling portrays a positive role for adolescents in grades 7-12, through mediation.

Review of Protective Resources

Ethnic identity – Effect on health-promoting behavior. Adolescence is highlighted as a key time for identity exploration and development (Erikson, 1968). Ethnic origin is a trait individuals are born with, thereby establishing ethnic group membership. Ethnic identity (EI) is an aspect of identity development that is especially relevant to minority youth and is related to one's membership in an ethnic group resulting in how individuals view themselves, relative to the ethnic group (Greig, 2003). Phinney and Chavira (1992) add that EI is the feeling of belonging, pride, and esteem associated with being a member of one's own ethnic group. The spirit of ethnicity is based on group members' attitudes and behaviors regarding ethnicity, cultural heritage, values, beliefs, customs, interactions with other groups, and view of society as a whole (Phinney, 1996). As such, most research on EI is based on the study of group identity. Thus, the measurement of EI is based on an individual's self-identification with a particular group, regardless if the label is of ethnic or racial origin (Phinney & Ong, 2007). EI most often serves as a moderator to buffer risks and unhealthy outcomes from risks. In terms of holistic development and healthy outcomes for adolescents, the important aspects of EI are connection and resilience, which lead to a secure, confident sense of self (Austin, 2004; Juang, Nguyen, & Lin, 2006; Smith & Silva, 2011).

Establishment of EI is a fluid process that occurs in three stages beginning in early adolescence (Chao & Otsuki-Clutter, 2011) with full achievement and internalization realized during late adolescence and at times, into the emerging adulthood phase of development (Gonzalez-Figueroa & Koniak-Griffin, 2006; Phinney, 1996;

Phinney & Ong, 2007). Achieving EI entails integrating the culture, values, and beliefs of the member group into an individual's worldview. There is initial evidence available indicating that EI is meaningfully conceptualized as early as middle childhood, echoing identical themes found among adolescent and adult data (Rogers et al., 2012). Development of EI is contextual and very individualized as related to the adolescent's ecology of family, school, and neighborhood (Chao & Otsuki-Clutter, 2011; Juang et al., 2006; Phinney, 1996). Girls typically score higher on EI scores than boys. This has been attributed to the matriarchal cultures such as Native American and Hispanic populations (Schweigman, Soto, Wright, & Unger, 2011; Umana-Taylor et al., 2009).

The EI developmental trajectory for adolescents of European American descent is unlike their minority counterparts (Perron, Vondracek, Skorikov, Tremblay, & Corbière, 1998; Phinney & Alipuria, 1990) because they develop within the context of the majority race and ethnicity in the United States (Greig, 2003; U.S. Census, 2011). According to the 2010 U.S. Census (2011), approximately 16% of the population is of Hispanic origin and over half of those identified as White race. Although the non-Hispanic White population declined to 64% overall and are the slowest growing race, they are still the majority race in the United States. The Asian population grew more than other races and total 5% of the population. African Americans account for 17% of the total population with most identifying as non-Hispanic ethnicity African Americans. Hispanic and non-Hispanic mixed races (up to four races) is 7% of the total population. It is often a specific event, such as the recent immigration debate, that initiates the exploratory phase of EI development in adolescents (Roehling, Jarvis, Sprik, & Campbell, 2010). Among 196

college age participants, Blacks and Mexican Americans demonstrated a stronger search for understanding the role of ethnic identity in their lives, than Whites or Asian Americans (Phinney & Alipuria, 1990).

A strong sense of EI serves in a protective role for adolescents to promote health and well-being (Smith & Silva, 2011). Love et al. (2006) determined that a strong EI protected Mexican American youth from engaging in risky and unhealthy behaviors. Adolescents with low EI demonstrated increased vulnerability for engaging in negative health behaviors (Austin, 2004). In regard specifically to negative discrimination experiences, EI functioned as a moderator to protect the psychosocial function of Navajo adolescents (Galliher, Jones, & Dahl, 2011) and African Americans who experienced online discrimination (Nagoshi, Marsiglia, Parsai, & Castro, 2011). Higher EI, as an interaction variable, is associated with academic success in Asian Americans, Native Americans, African Americans, and Hispanics (Meeus, 2011; Miller & McIntosh, 1999; Schweigman et al., 2011). Another developmental attribute associated with a strong EI is self-esteem. During the exploratory phase of identity development Latino, Native American, and Asian American adolescents experience a parallel growth in self-esteem as EI strengthens (Jones & Galliher, 2007; Juang et al., 2006; Phinney & Rosenthal, 1992; Umana-Taylor et al., 2009). Smith & Silva (2011) found that the value of EI as a protective resource is mitigated when adolescents experience mental health symptoms.

A positive attitude toward one's ethnicity is important for the health and psychological function of minority adolescents. Greig (2003) synthesized multi-disciplinary research findings and concluded that fostering positive EI development

should be a priority nursing goal. Normative EI development has strong implications for positive mental health outcomes in minority adolescents (Greig, 2003). Multi-disciplinary databases are devoid of studies exploring the association of EI with physical activity. Nor were any studies located presenting EI in the interaction role promoting physical activity in adolescents. The EI construct is a positive quality supporting adolescent development. Further research is needed to explicate the usefulness of EI for future interventional actions aimed toward promoting holistic adolescent health, specifically participation in physical activity.

Health awareness – Effect on health-promoting behavior. Adolescence is a period in life when individuals begin to make decisions about their personal lifestyle and health behaviors. This period of transition is a prime time to influence health knowledge and health behaviors that will become apparent in the transition to adulthood (Nelson, Lytle, & Pasch, 2009). Parents, peers, and teachers are primary sources of adolescent health information and health socialization. Although the Internet, radio, social media, and television profoundly impact how adolescents access and receive health information, all types of mass media are considered a secondary source of health information (Lariscy et al., 2010). A middle stage adolescent relates:

> I think for a lot of us teenagers it's hard to find something active to do. You have to tell me, like, how it's going to help me, and what you can do to help me. Then I might want to eat the fruit or go exercise. (17-year-old son) (Berge et al., 2012, p. 127)

Developmentally, older adolescents report that they actively seek health information on the Internet more so than when they were in younger stages of development (Regber & Kelly, 2007). Overall, 28% of youth seek information online

(Jones & Fox, 2009). When evaluating media information, early stage adolescents are less apt to have the necessary skills for differentiating between advertising, entertainment, or news reports. Early stage adolescents also indicate that friends and television reports may provide the wrong health information (Brown, Teufel, & Birch, 2007). Little evidence exists on how media affects adolescent health-behavior decisions. Pinkleton et al. (2008) designed an interactive, teen-led, media literacy program with potential outcomes to enhance teen understanding of media messages and positive health-behavior. Teens (11-19 years) demonstrated that the program stimulated thinking about media images. They confirmed that positive learning and efficacy for health-behavior occurred. There were no sex differences in the knowledge gained, but boys understood media influence on health better than the girls in the study.

Translation of health information into knowledge, adolescent health awareness, and subsequent health-promoting behaviors is an individual process. Normative developmental maturity, coupled with health knowledge, leads adolescents to consider their personal health status. Adolescents' knowledge of their bodies, along with awareness of their health status, consistently evolves. Early adolescents tend to deny negative outcomes related to health-risk behaviors, regardless of health promotion messages (Regbar & Kelly, 2007). By mid-adolescence, individuals have attained the health literacy skills that enable them to access and evaluate the validity of health information (Sanders et al., 2009). A brief review of studies concerning the relationship among adolescent health-promotion knowledge, awareness, and behaviors ensues.

Data described and interpreted by O'Haver et al. (2011) suggested that knowledge of healthy food choices was not enough to effect overweight or healthy weight adolescents' positive changes toward choosing healthy foods to consume. In addition to health knowledge, adolescents must also learn to translate the knowledge into healthful practices (Croll, Neumark-Sztainer, & Story, 2001). Knight (2005) determined that having health knowledge alone was not sufficient for adolescents to manage their asthma. Mahajerin et al. (2008) stated that adolescents' knowledge of risk factors associated with the complications of diabetes mellitus type 2 was not associated with implementation of healthful or risk-reducing behaviors. Mahajerin et al. (2008) concluded health knowledge and health awareness might not always translate to health-seeking behaviors.

Knowledge acquisition, coupled with self-efficacy and cognitive development, combine to permit adolescents to contemplate their health risks and health strategies (Knight, 2005; Pinkleton et al., 2008). For example, older adolescents with more mature thinking agreed that smoking, while also having a diabetic condition, increased their health risks (Regbar & Kelly, 2007). Andreeva, Reynolds, Buller, Chou, and Yaroch (2008) established direct and indirect effects of health knowledge on sun safety, across sex and ethnicity. Specifically, adolescent knowledge about sunburn and skin cancer predicted sun safety behaviors. After participating in a media literacy campaign, adolescents aged 11-19 developed a higher level of efficacy toward health-related decision making, and were less likely to consider risky sexual behaviors as a desirable lifestyle choice (Pinkleton et al., 2008). Results of a study by O'Haver et al. (2011) support the relationship between health awareness and efficacy toward healthy choices.

They determined that teens who possessed more knowledge about nutrition and activity perceived they could live a healthier lifestyle, and consequently made healthier lifestyle choices. As efficacy and agency develop and strengthen, adolescents make informed decisions to take charge of their health management and health outcomes within their personal social context (Wharf-Higgins et al., 2009).

Race, ethnicity, and sex differences in health knowledge, awareness, and behaviors exist. Literature examining associations between health awareness and adolescent health promotion behaviors is available but in regards to physical activity participation as a health-promoting behavior, studies were not found. Studies that indicate a disparity among racial and ethnic minority adolescents regarding health awareness and health-promoting behaviors are common. For example, more than two decades ago, Vaz, Best, and Davis (1988) found that a yearly physical exam was a strong independent correlate of testicular self-exam in adolescents. Yet, Benz, Espinosa, Welsh, and Fontes (2011) assert that the disparity in healthcare access among minority youth influences adolescent health knowledge of testicular cancer and testicular self-exam. An additional example of disparity for racial and ethnic minority youth is awareness of the human papillomavirus (HPV) and vaccine. Gelman, Nikolajski, Schwarz, and Borrero (2011) found a marked disparity in knowledge of HPV and awareness of the HPV vaccine, among a large sample of young, vaccine eligible, minority women, aged 15 to 26 years. Additionally, actual vaccination rates were lower in minority Black and Hispanic women. The lack of HPV awareness and vaccination could result in a greater number of negative health outcomes for minority females.

Each adolescent develops health awareness influenced by their individual developmental and sociocultural factors. Thus, the association between adolescent health awareness and health-promoting behaviors may be viewed as a continuum from early to late adolescent stages and into the emerging adulthood years. Minority status may have a negative bearing on acquisition of basic health information and health-promoting strategies. Adolescent development, in addition to social context, plays a significant role in adolescent translation of health knowledge into personal health awareness that manifests into health-promoting behaviors. Adolescents possess diverse learning styles and intelligences (Fetro, 2010). Therefore, understanding the concept of risk entails a developmental trajectory toward the ability to discern accurate and reliable health information.

Social connectedness – Effect on health-promoting behavior.

> We support what people want to try [physical activity]. If someone's interested in something, and it is something the family can do, we all try it together. Like Susie was showing interest in baseball, so we said, let's get a couple of gloves, a ball, and bat and let's just go try to bat it around together. And we spend our family time doing that. (40-year-old mother) (Berge et al., 2012, p. 127)

Social connectedness is the adolescent's sense of belonging and interaction in meaningful relationships with caring adults. Karcher (2001) describes connectedness with synonymous concepts such as relatedness and attachment, to indicate an experience of feeling included and caring. In their nationally representative sample, Resnick et al. (1997) found consistent evidence that adolescent perception of caring and connection is important to the health of youth. Connection is a critical resource in protecting adolescents from poor developmental and health outcomes (Henrich et al., 2005; Resnick

et al., 1993) as youth connect with and form relationships within specific contexts, such as family, schools, and communities (Karcher, 2001; Minnesota Department of Health, 2010). Connectedness is sometimes referred to as caring or nurturing that is most commonly found in the context of family (Karcher, 2001; Resnick et al., 1993). Bornholt and Piccolo (2005) found that a sense of belonging or connection contributed to the self-concept of movement in older children, which in turn, supports lifetime participation in physical activities.

Connectedness, as a protective factor, falls under the purview of family bonds (Rew, 2003) and promotes social and emotional competence (CDC, 2009). Individual identity, beliefs, values, and behaviors stem from an early sense of bonding interaction and connection (Bernat & Resnick, 2009). Caring relationships work in a positive fashion to reduce adolescent vulnerability to stress and health risks. To place connectedness in the social perspective, adolescents who feel connected to teachers, coaches, counselors, and peers at school believe that those individuals care about them and their learning. Caring within the school connection influences positive development (Bernat & Resnick, 2009) and educational outcomes for adolescents (CDC, 2009). Family and school connections are critical contexts for researchers to explore regarding health and health-risk behaviors (Resnick et al., 1997). Social connectedness is a very important research target for enhancement and interventions, to improve positive health outcomes and health-promoting behaviors in adolescents.

Family connection is important for adolescents. Parents and family are the bedrock for youth as they navigate the sometimes tumultuous pathway to young

adulthood. During this journey, parent-teen connection is associated with less anxiety and depression and positive self-worth (Ackard, Neumark-Sztainer, Story, & Perry, 2006) as well as lower levels of health-risk behaviors (Bernat & Resnick, 2009). Relative to health and health-risk behaviors, girls who valued peer opinions over their parents' opinions reported engaging in more health-risk behaviors (unhealthy weight control and suicide attempts) than peers who had satisfactory and higher levels of parental communication and caring (Ackard et al., 2006). Boys in the same study demonstrated similar patterns resulting in their engaging in unhealthy weight control, substance use, and suicide attempts. These same participants exhibited negative emotional health outcomes when there was pathology in the parent-child caring relationship. Earlier research demonstrated similar findings. Resnick et al. (1997) reported that family connection was significantly and inversely associated with physical health-risk indicators. They further expound, that parent-family connection protects against emotional distress in early and late adolescence.

> I think it [physical activity] is a lot more fun when you are, like, with some of your family, because you have someone to talk to and it goes so much quicker, before you know it you've probably walked around the lake twice and you didn't realize it. (12-year-old daughter) (Berge et al., 2012, p. 128)

Summary

Reducing the incidence and prevalence of childhood obesity depends upon increasing physical activity (Katzmarzyk et al., 2008). Available data indicate that engaging in a high level of physical activity yields a low risk for developing obesity. There is a plethora of publications focusing on obesity and physical activity, but additional studies are needed to clarify relationships between existing constructs and to

identify new determinants and predictors, especially among minority youth who are at a higher risk for low levels of physical activity (Heitzler et al., 2010). Involving youth in organized sports and activity ventures are central to increasing physical activity in adolescents. Furthermore, weekends and after-school hours are prime times for promoting physical activity in adolescents and this may include parental proxy and family activities. Identification of key moderators of physical inactivity is of essence to guide future evidenced-based interventions that will assuage endemic inactivity and reduce the resulting burden of disease in the lives of our adolescents. There is a paucity of research findings explicating how determinant interactions influence activity levels. Physical activity is a priority intervention, but further research is needed to determine actual social and environmental factors implicated in adolescent activity values, attitudes, and behaviors. If sustained, a meaningful increase in adolescent physical activity will translate into health benefits (Graham et al., 2008). Parent and peer social support hold a promising route for health-promotion initiatives (Duncan et al., 2007). Effective change and maintenance in the activity level of adolescents is paramount. This study aimed to enrich the theoretical and evidence-base that informs public health policy and health-promotion agendas targeted at increasing physical activity among adolescents.

CHAPTER III: METHOD

The purpose of this chapter is to describe the research methods used to conduct the secondary analysis of data in the extant longitudinal databases *Longitudinal Health Risk Behaviors in Youth* (LongHerby) and *Developing Health Behaviors in Middle Adolescence* (DHBMA). Adolescent physical activity was studied in the context of a protective resilience trajectory, through examination of empirically supported risk factors for physical inactivity and proposed moderating protective resources. The instrumentation and proposed statistical analysis procedures conducted in the secondary analysis were presented. The sample, data collection procedures, and human subject considerations from the parent longitudinal studies, were described.

Parent Studies

The parent studies of this secondary analysis were cohort sequential, longitudinal studies, conducted in the southwestern US by Lynn Rew, EdD, RN, AHN-BC, FAAN, Principal Investigator. The first study was LongHerby and comprised children in the transitional phases from pre-adolescence to early adolescence in Grades 4-8 (Rew, Horner, & Fouladi, 2010). The LongHerby study allowed for analysis of individual risk factors, protective resources, and child health behaviors that predicted health-risk behaviors in early adolescence. The extension study was DHBMA and followed the same participants from the early stage of adolescence through middle adolescence in Grades 9-12. Beginning with ninth graders, DHBMA examined the impact of additional risk and protective factors, as well as other health-risk behaviors that manifest in early adolescence, on health-behaviors. DHBMA enriched the LongHerby study by allowing

examination of additional research questions, and testing of specific hypotheses, with a special emphasis on comparisons by sex and ethnicity. In addition, DHBMA allowed for the exploration of interactions to predict health-promoting behaviors over time.

Design of the Current Study

The objective of the current study was to describe the dynamics that underpin adolescent physical activity participation, specifically in relation to individual risk factors and protective resources among an ethnically diverse sample of adolescents. A descriptive, correlational design was used in this secondary analysis of extant longitudinal data. The dependent variable was physical activity participation when students were in Grade 9. Data for the predictor variables were collected in Grade 8 and Grade 9. Predictor variables evaluated were categorized as protective resources (for physical activity) or risk factors (for physical inactivity or low activity). The potentially modifiable protective resource variables were ethnic identity, health awareness, and social connectedness. The potentially modifiable risk factor variables were BMI percentile, media use, and parental activity, along with fixed and non-modifiable demographic variables of sex, race, and ethnicity.

Setting

The setting for the original longitudinal study was in the southwestern US. The LongHerby study was conducted in three independent school districts. Geographically, the school districts comprised low-income neighborhoods and rural communities. The DHBMA extension study continued with participants who originally enrolled in

LongHerby, when they attended public grade schools in these three school districts. The data collection procedures are explained below.

Sample

A convenience sample of 1,934 participants, enrolled in Grades 4-6 were recruited for the LongHerby study. The potential sample pool was 6,700. The combined populations of all three school districts were comprised of Mexican Americans (42-48%), Anglo Americans (36-49%), African Americans (4-21%), and Asian Americans and American Indians (.05-1%). Approximately 50% of those students were considered economically disadvantaged. The focus of LongHerby was a comparison of Anglo Americans and Mexican Americans, but data were collected from students in all ethnic groups. The DHBMA study extended data collection with participants who originally enrolled in LongHerby. The sample was comprised of multi-ethnic rural youth, many of whom were economically disadvantaged ethnic minorities. There were 1,806 school-aged children enrolled in the DHBMA study of which 54% were female. The ethnic make-up was 50.2% Mexican American, 30.3% Anglo Americans, 9% African Americans, and 1% Asian Americans, Pacific Islanders, and American Indians combined; the remaining participants were mixed race and ethnicity and 50% of this population was economically disadvantaged.

Sample Selection for Secondary Analysis

A convenience sample of 251 participants was selected for the secondary analysis. Participant inclusion criterion was determined based on the results of the power analysis, which suggested selecting 110 participants with complete data. The Grade 8 data were

stored in the LongHerby database and the Grade 9 data were stored in the DHBMA database. A new database was created for this study by merging data from these parent databases, for the selected risk factors (Grade 8 and 9), the protective resources (Grade 9), and the outcome variables. Participants that lacked a complete dataset were eliminated from the potential pool of participants and this resulted in availability of data for 251 participants for the secondary analysis.

Power Analysis

Statistical power analysis expresses the relationships among four factors that are engaged in inferential testing of datasets. In preparation for this study, a power analysis was conducted to estimate the sample size required for a multiple regression analysis: fixed model, R^2 increase. Using the software, G* Power, Version 3 and these parameters: 9 predictor variables, a significance criterion of α (p = .05), a medium effect size for multiple regression (R^2 = 0.15), and a power of 1-β (.80), approximately 110 participants with complete data were necessary for the correlational and regression analysis (Faul, Erdfelder, Buchner, & Lang, 2009).

Human Participant Protection

To ensure the protection of human participants, a proposal was submitted to the University Institutional Review Board (IRB) for review and approval, prior to beginning this study. Participant confidentiality, as well as survey and database security, were maintained as in the original studies.

The IRB at the University reviewed and approved the original and extension longitudinal studies. IRB review and oversight was not required for this secondary

analysis. The IRB letter is in Appendix A. No actual or potential risks to the participants and parents or guardians were identified. During the consent and assent processes, participants and parents were advised all data would be kept confidential and securely locked in the principal investigator's research office at the University, unless the adolescent participant indicated a potential for suicide. In that case, the parent or guardian was immediately notified and provided with a list of community resources. The DHBMA survey posed two potential concerns for inconvenience: (a) time commitment for completing the survey and (b) anxiety related to the sensitive questions about sexual activity, drug and alcohol use, and suicide. The importance of maintaining a multi-culturally sensitive instrument was acknowledged by the principal investigator. Participants were instructed that they did not have to answer any questions that made them feel uncomfortable. All consents and data collection instruments were translated and made available to participants in Spanish.

Parental consents and participant assents, along with all completed paper data surveys are filed in locked cabinets, in the LongHerby and DHBMA principal investigator's research office. Only the principal investigator, project managers, and graduate research assistants have had access to the files. The principal investigator of this dissertation was granted access to the LongHerby and DHBMA databases for the dissertation study.

A secure database with codebook was created by a graduate research assistant, as parental consent for their child's participation in the study was received. To further protect confidentiality, all participants were assigned numeric code numbers that were

placed in a separate data file. As participant surveys were received in the research office, the survey data were entered into the electronic database using only the code number for identification. Because the identity of participants is potentially retrievable, a Certificate of Confidentiality was received from the National Institutes of Health (funding agency) for both studies. Database security has been maintained throughout the study. A data and safety monitoring board, comprised of members not directly involved in data collection, reviewed the data collection and storage annually throughout the DHBMA study. The files will be kept for a period of 10 years following the end of the study (June 30, 2012) and then properly destroyed.

Procedure

A multi-ethnic school-community advisory council was formed to work with the research team in developing protocols for establishing cultural relevance for recruitment of participants, data collection, tracking participants over time, appropriateness of incentives, the measurements, and disseminating findings for the study. The advisory council met with the principal investigator annually to ensure cultural and developmental relevance of the LongHerby study. Letters providing access to the school age children were received from officials at each school district. Two feasibility studies, approved by the University IRB, were conducted in preparation for the DHBMA extension study. Following a small pilot study, qualitative inquiry was added to the DHBMA study. The DHBMA study provided a unique opportunity to develop the scientific knowledge base of adolescent health-risk and health-promoting behaviors, providing evidence for future

theory-based intervention and policy development, to improve health indicators through all phases of adolescent development.

Recruitment and Enrollment of Participants

Parents voluntarily enrolled their children in the LongHerby study. The children's written assent was obtained prior to data collection, and was renewed every year the child participated in the study. Written parental consent was also obtained each year of the study. Preliminary findings from LongHerby suggested the resilience framework would be helpful in explaining early development of health-promoting behaviors. Findings also suggested there were both sex and ethnic differences in health-risk behaviors and the variables that predicted those behaviors (Rew et al., 2010). All participants who were enrolled in the LongHerby study of health-behaviors were eligible to participate in DHBMA as they entered Grade 9. Written consent from parents and written assent from minors were obtained annually for the DHBMA study as well.

Data Collection

Parental consent for child participation was required prior to inviting the children to the data collection sessions (see Appendix B). Baseline data were gathered from students enrolled in fourth, fifth, and sixth grades in the aforementioned school districts, by trained graduate research assistants. The survey was administered in single one-hour sessions. Data were collected in groups of 25-30 participants at one time. Individual make-up sessions were arranged for children who missed one of the available sessions or who needed extended time to complete the survey. A few students who missed in-school sessions were sent paper copies of the surveys to complete and mail back to the

investigator. Baseline data were collected from parents on a brief self-report form by postal mail or telephone survey. All students and parents who completed surveys were awarded a $10.00 incentive coupon, for use at a local department store.

Data collection for DHBMA occurred in the home of the youths rather than in the schools. Baseline data by self-interview surveys using laptop computers and self-reports of behavior were collected for five years as each cohort entered Grade 9. Parents and adolescents completed surveys in Year 01, in separate rooms in their home. Parent data were collected only once when the adolescent was first enrolled in DHBMA. Both the adolescents and the parents were awarded $25.00 gift cards to a local department store, upon completion of the extensive survey.

Throughout the data entry process, written survey responses were entered into the database by a graduate research assistant, in the research office. To ensure accuracy, data were entered into the database once again by a different graduate research assistant. Data from the computer-assisted collection procedure were entered directly into the database immediately following data collection in the participant's home. Data were reviewed for accuracy a third time during the cleaning process. Data discrepancies were corrected by returning to the original data collection tool, to identify the actual participant response. The data have been securely maintained by the DHBMA research staff with rigorous attention toward a complete dataset for all participants.

Tracking and Attrition

A specific protocol was followed to assure continuity in tracking individual longitudinal data and to promote retention in the parent study. Each participant was

assigned a numeric code number that was filed along with the participant's name, phone number, address, and e-mail address. The data file was updated monthly. Each child enrolled in the study received a birthday card annually with a reminder to keep investigators informed of address, phone number, and e-mail address changes. Participant retention in DHBMA was maximized by collecting data during the summer months, on weekends, and in the evenings when feasible.

Instrumentation

A battery of valid and reliable instruments related to the constructs of the guiding conceptual model were used to measure the risk factors, protective resources, child health-behaviors, and health-risk behaviors in LongHerby. All research instruments were translated into Spanish by a professional translator who was fluent in Mexican-Spanish and English. The instruments were then back-translated into English by a second individual fluent in Mexican-Spanish and English, and who had not seen the original instruments. A second battery of valid and reliable instruments was used to measure the contextual and risk factors, protective resources, and health-behaviors that are the focus of DHBMA. Translation and back-translation of the instruments were completed as previously described. In addition, an advisory panel not involved in the initial translation or back translation was consulted for clarity and appropriate wording of all scale items.

Adolescent participants and at least one parent completed surveys that included measures assessing the proposed risk factors, protective resources, and outcome variables. Prior to completing the surveys adolescent participants and parents completed

demographic items that included information regarding adolescent sex, race, ethnicity, birthdate, and date the survey was completed.

Instrumentation Used in the Current Study

The instruments that were used to measure the variables in this dissertation study are described in this section, summarized in Table 3.1, and found in Appendix C.

Table 3.1

Summary of Variables and Instruments for Measuring Variables

Variable	Scale Name	Data Collection Time	Completion by Whom
Risk Factors			
Sex Race Ethnicity	Demographic Form (DF)	Upon Enrollment in DHBMA	Parent of Student Participants
Body Mass Index (BMI)	Youth Risk Behavior Surveillance Scale (YRBSS) Body Weight Subscale	Grade 8	Student Participants in Grade 8
Media Use	Use of Mass Media	Grade 9	Student Participants in Grade 9
Parental Activity	Self-Care Inventory (SCI)	Upon Enrollment in DHBMA	Parent of Student Participants
Protective Resources			
Ethnic Identity	Multigroup Measure of Ethnic Identity (MMEI)	Grade 9	Student Participants in Grade 9
Health Awareness	Adolescent Lifestyle Questionnaire (ALQ) Health Awareness Subscale	Grade 9	Student Participants in Grade 9
Social Connectedness	Social Connectedness Scale (SCS)	Grade 9	Student Participants in Grade 9
Health-Promoting Behavior			
Physical Activity	Youth Risk Behavior Surveillance Scale (YRBSS) Physical Activity Subscale	Grade 8 Grade 9	Student Participants in Grade 8 and 9
Physical Participation	Adolescent Lifestyle Questionnaire (ALQ) Physical Participation Subscale	Grade 9	Student Participants in Grade 9

Demographic Information Form (DIF)

Parents completed a self-report demographic information form. This form was designed specifically for the LongHerby study and was used to collect individual and sociocultural contextual risk data about the child participants. Data collected with this tool included family and neighborhood characteristics, along with a child temperament scale. Data from this form will not be used in the current study. However, the DIF was adapted for DHBMA and included the participants' birthdate, sex, race, and ethnicity. The form was completed by the adolescent's parent upon enrollment in the DHBMA study, when adolescent participants were in Grade 9. Participant sex, race, and ethnicity are non-modifiable risk factors for physical inactivity.

Youth Risk Behavior Surveillance Survey (YRBSS)

The YRBSS scale was developed in 1990 by the CDC (2012d) to assess prevalence of adolescent health and health-risk behaviors. The YRBSS monitors six categories of health-risk behaviors for adolescents in Grades 9 through 12: (a) inadequate physical activity, (b) unhealthy dietary behaviors, (c) tobacco use, (d) alcohol and other drug use, (e) sexual behaviors that contribute to unintended pregnancy and sexually transmitted diseases, and (f) behaviors that contribute to unintentional injuries and violence (CDC, 2013). At the time of the parent study, the scale contained 79 items. The YRBSS survey is written at a seventh grade reading level and initially had inconsistent reliability scores from seventh graders. Thus, Brener, Collins, Kann, Warren, and Williams (1995) suggested the survey be administered to students in or above Grade

8. This survey was used in the LongHerby study for seventh and eighth graders, as well as being incorporated into the DHBMA measures in Grade 9.

Body mass index (BMI). An elevated BMI percentile is a modifiable risk factor for adolescent physical inactivity (Rowland, 1999) and is the recommended measure for the identification of overweight and obesity in children and adolescents (Dietz et al., 2009). BMI-for-age charts are recommended by the CDC (2011a) to assess weight in relation to stature for children ages 2 to 19 years. The BMI value is then plotted as a percentile on the BMI-for-age charts. The percentile indicates the relative position of the child's BMI number among children of the same sex and age.

Participants' BMI percentiles were calculated from data collected when they were in the Grade 8. The YRBSS, Section 7, concerning body weight, includes item one (height) and item two (weight) self-reports, that were used to determine participant BMI percentiles. Brener, McManus, Galuska, Lowry, and Wechsler (2003) conducted a validity study on self-reported height and weight measurements. When compared to objective height and weight measurements, they determined that BMI calculated from self-reported data values were valid and reliable. On average, students in the study over-reported their height and underreported their weight, which indicates that the YRBSS probably underestimates the prevalence of overweight in adolescent populations.

Media Use

This scale was prepared for the DHBMA study by Dr. Lynn Rew, PI. The items were developed from a review of studies published by Brown and Witherspoon (2002). The survey is a 30-item checklist, divided into three subscales, and designed to measure

adolescent usage of mass media on a daily basis. Items are measured by mean scores to provide the number of hours per week each type of media was used by the participant in his or her room at home (Items 1-10), in the home but not in his or her room (Items 11-20), and outside the home (Items 21-30). The more hours spent in media use the higher the risk level is for adolescent physical inactivity. Cronbach's alphas for the 10-item subscales were mass media use in room ($\alpha = .721$), in the home ($\alpha = .729$), and outside the home ($\alpha = .794$), for this study.

Parental Health-Risk Behavior

The parent self-care inventory contains 39 items with a 4-point Likert response format that asks frequency of health-related behaviors. The items include various health-risk behaviors such as physical inactivity, poor dietary habits, sleep patterns, impaired driving, and drug use for non-medical purposes. Validity has been reported through correlations with psychological symptoms and factor analysis; the scale has a test-retest reliability coefficient of 0.80 and Cronbach's alpha of 0.78-0.85 when used with mothers (Walker et al., 2004). Three items were used from this survey to assess for parental activity, as a risk factor for adolescent physical inactivity. Lower mean scores indicated physical inactivity by the parent responding to the survey. Cronbach's coefficient of reliability for the 3 item physical activity subscale was $\alpha = .713$.

Ethnic Identity

The Multigroup Measure of Ethnic Identity (MMEI) is a general measure that assesses ethnic identity across diverse cultural groups (Phinney, 1992) and measures "aspects of ethnic identity that are common to all ethnic minority groups" (p. 165). The

MMEI was used to measure the adolescent's identity in relation to ethnic group membership in the DHBMA study. The scale consists of 14 items with a 4-point Likert response format, where lower mean scores indicated higher levels of ethnic identity. For analysis convenience, the scale was reversed so that lower mean scores indicated lower levels of ethnic identity. The MMEI produced evidence of one and two factor validity (Phinney, 1992). Cronbach's alpha coefficient of reliability was 0.81 when the scale was given to a sample of 417 Anglo American, Asian American, African American, and Hispanic high school students (Phinney, 1992). The ethnic identity inventory was found to be highly reliable for this sample (14 items; $\alpha = .876$).

Health Awareness

Health awareness was measured using a subscale of the Adolescent Lifestyle Questionnaire (ALQ). The ALQ is an instrument that was developed to measure healthy lifestyle practices in adolescents. Defined for the ALQ, health awareness incorporates health-promoting and health-protection behaviors (Gillis, 1997). The healthy lifestyle profile was created from adolescent qualitative interview data that yielded seven distinct, but related elements that were also isolated with factor analysis, and included the health awareness subscale. The scale provides a 6-point response format. Total scale alpha reliability coefficient was 0.91 when used with 292 adolescents ages 12-19 (Gillis, 1997). Subscale alphas ranged from 0.60 to 0.88. The scale developer (Gillis, 1997) encouraged further testing within diverse adolescent populations.

The health awareness subscale of the ALQ consists of four items with modest internal consistency (0.71) when used with 292 adolescents ages 12-19 (Gillis, 1997).

Conceptually and theoretically, health awareness is a protective factor that moderates risks toward adolescent physical inactivity. Cronbach's reliability coefficient was highly reliable ($\alpha = .789$), in this sample.

Social Connectedness

The Social Connectedness Scale was originally written for use in the Adolescent Health Survey and labeled the Family Integration Scale (Blum, Harris, Resnick, & Rosenwinkel, 1989). It contains 10 items with a 4-point response format, where lower mean scores indicated higher levels of social connectedness. For analysis convenience, the scale was reversed so that lower mean scores indicated lower levels of social connectedness. The original scale had a Cronbach's alpha of 0.92 for females and 0.96 for males, in the seventh grade. The social connectedness inventory was found to be highly reliable for females and males in this study ($\alpha = .869$).

Physical Activity Participation

Physical activity participation is measured on the Adolescent Lifestyle Questionnaire (ALQ) survey (Gillis, 1997). Physical participation refers to the adolescent's active participation in sports, exercise, or other physical activity participation such as swimming, dancing, walking, or running. Physical activity participation is a health-promoting behavior outcome variable in this study. Content validity and empirical validation of the ALQ was completed and published by Gillis (1997). The physical participation subscale consists of four items and demonstrated an excellent alpha coefficient of 0.82 when used with 292 adolescents ages 12-19 (Gillis, 1997). Cronbach's alpha for this study sample was excellent ($\alpha = .884$).

Physical Activity

The YRBSS physical activity subscale assesses adolescents' participation in daily physical activity. The subscale consisted of seven items with reliability of 0.82 for seventh graders in the principal investigator's original study. This study utilizes three of seven available items (1-3) to illustrate adolescent participation in physical activity. The three items selected for examination describe the frequency and intensity of the adolescent physical activity participation and muscle strengthening. An overall physical activity participation score was derived from the mean of responses on each question, for each adolescent, where higher scores indicated more activity.

Reliability of the YRBSS physical activity subscale was examined (Brener et al., 2002) and produced a low-moderate mean kappa score (55.2%). One physical activity participation item will not be used in this study based on low reliability and subsequent deletion from the 2011 YRBSS. Since the YRBSS survey is a self-report measure, validity of the scales is subject to limitations and bias. Brener, et al. (2003) conducted a literature review that provided evidence of validity of the YRBSS measures. The review demonstrated that cognitive or situational factors may influence self-reports without necessarily threatening the validity of the scales. Reporting physical activity behaviors can be affected by cognitive factors such as recall (of physical activities) and making judgments about the duration and intensity of activities. Brener (2003) concluded that the YRBSS physical activity reports can be validated with objective measures such as accelerometers, heart rate monitors, energy expenditure tests, and measures of fitness but those methods are not always the benchmark for comparison. The YRBSS physical

activity items used in this study minimize potential cognitive factor influences by assessing specific time duration (minutes and days) and providing specific examples of vigorous intensity activities.

Physical activity participation suggests a resilience outcome and is a health-promoting behavior variable in this study. Grade 9 Cronbach's reliability coefficient was calculated and did not demonstrate adequate internal consistency of the selected measurement items among adolescents who comprised the final sample (3 items; α = .632). Removal of item two that assesses moderate intensity physical activity improved the reliability (2 items; α = .750). The YRBSS physical activity Grade 9 scale used in subsequent analyses is comprised of the two items found to be internally consistent. The YRBSS physical activity items were designed so that each question could be used alone to measure different aspects of adolescent physical activity.

Grade 8 Cronbach's reliability coefficient was calculated and demonstrated adequate internal consistency of the selected measurement items among adolescents who comprise the final sample (3 items; α = .729). Removal of item two that assesses moderate intensity physical activity improved the reliability (2 items; α = .768). The YRBSS physical activity Grade 8 scale used in subsequent analyses was comprised of the two items found to be most internally consistent.

Selection of outcome variables. Participants scored their physical activity participation on two adolescent health behavior measures, as described above. The principal investigator analyzed data collected from the participants on both measures because the data offered two distinct ways of examining adolescent physical activity. The

YRBSS measures frequency (how many days) and intensity (activity that made you sweat and breathe hard) of physical activity more specifically than the ALQ physical participation scale. The ALQ scale used a Likert scale format to collect physical activity data. Using both outcome measures enriches this study and provides an opportunity for comparing the scales through correlation and regression analyses. The ALQ physical activity scale had validity studies completed and could provide validity for the YRBSS physical activity scale.

Preliminary Data Analysis

Data collected for this study were analyzed using the Statistical Package for the Social Science (SPSS for Windows, version 21). Data for secondary analysis were retrieved from two longitudinal datasets collected in the southwestern US, as previously described. A complete participant dataset that exceeded the requirement for power of the proposed analysis was obtained; therefore statistical procedures for missing data were not required. An alpha level of .05 was set a priori for all statistical analyses. Preliminary data analyses occurred in this sequence:

1. Descriptive statistics (means, standard deviations, or frequency distributions) for all variables were computed and examined.
2. Data were screened for outliers and regression assumptions.
    a. Data were screened via descriptive statistics, boxplots, histograms, stem and leaf plots, normality plots, and scatter plots.
3. Bivariate correlational analysis was completed to examine the relationships among the predictor variables and both physical activity participation outcomes.

4. Multiple correlation analysis calculations among the predictor variables were examined to detect strong relationships indicating that there is multicollinearity among the predictor variables.
5. Diagnostic multiple regression analyses were performed for both physical activity outcomes, to screen for regression assumptions.
6. Moderator models were developed and tested within the hierarchical regression analysis.

Specific Statistics for Research Questions

Research Question 1: What are the sex, racial, and ethnic differences in BMI percentiles when the participants were in Grade 8?

Research Question 2: What are the sex, racial, and ethnic differences in physical activity when the participants were in Grade 8?

Research Question 3: What are the sex, racial, and ethnic differences in risk factors (i.e., media use and parental physical inactivity) when the participants were in Grade 9?

Research Question 4: What are the sex, racial, and ethnic differences in protective resources (i.e., ethnic identity, health awareness, and social connectedness) when the participants were in Grade 9?

Research Question 5: What are the sex, racial, and ethnic differences in physical activity when the participants were in Grade 9?

The statistical procedure to determine differences in two independent group means (female and male; Hispanic and non-Hispanic; minority and White) was the *t*-test.

This analysis was preceded by data screening for assumption violations. The assumption of normality of the data, homogeneity of variance, and independence were reviewed. All data were measured at the interval level except the demographics. The demographic variables were categorical.

Research Question 6: What is the nature of the relationships among the BMI percentiles (measured in Grade 8), physical activity participation (measured in Grade 8), and physical activity participation when the participants were in Grade 9?

Correlations were calculated to explain the direction and magnitude of the relationships between early adolescent BMI percentiles and physical activity participation of early (Grade 8) and middle adolescents (Grade 9).

Research Question 7: Do BMI percentiles measured in Grade 8 predict physical activity measured in Grade 9?

A correlation between these variables was necessary for a regression analysis to be performed.

Research Question 8: Does physical activity measured in Grade 8 predict physical activity measured in Grade 9?

A simple linear regression analysis was performed to test if physical activity measured in Grade 8 significantly predicted physical activity in Grade 9. Two regressions were performed, one for each measure of physical activity in Grade 9.

Research Question 9: What is the nature (direction and magnitude) of the relationships among risk factors, protective resources, and physical activity when the participants were in Grade 9?

Bivariate and multiple correlation analyses were completed during the preliminary data screening process to explain the direction and the magnitude of the relationship between the risk factors, protective assets, and physical activity participation.

Research Question 10: Do the protective resources moderate the effect of the risk factors on physical activity when participants were in Grade 9?

Hierarchical multiple regression analyses with block-entry was conducted to explain the effects of the risk factors and protective resources on adolescent physical activity participation. This analysis was preceded by data screening for outliers, assumption violations, and a correlational analysis between the risk factors, protective resources, and physical activity. Moderator variables were created for the hierarchical multiple regression analysis.

The hierarchy of variable entry was based on the conceptual model for this study. Predictor variables (risk factors and protective resources) and interaction terms that were statistically significantly correlated with the outcome variables were entered into the regression analyses in a sequential block method. The first block entered was composed of the non-modifiable risk factors (sex, race, and ethnicity). The modifiable risk factors (BMI percentile, media use, and parental activity) were entered as block two. Next, based on theoretical rationale, the protective resources were added into the model individually in this order (1) social connectedness, (2) ethnic identity, and (3) health awareness. Moderator interactions among the risk factors and protective resources were entered into the model last. Interaction terms entered into the hierarchical regression in their own steps allowed for analysis of the main effects of the independent variables separately

from the effect of the moderator. The model summary and the coefficients table were evaluated for model success and significance, with results presented in the following chapter.

Summary

In this chapter, the principal investigator described the methods used to answer the research questions posed in Chapter 1. The research design, setting, sample, participant protection, procedures (enrollment, data collection, tracking and attrition), and a brief statement of instrumentation used in LongHerby and DHBMA, were discussed. Description of the secondary analysis included design, power analysis, human participant protection, instrumentation, and concluded with statistical analysis organized by 10 research questions. Chapter Four contains the results of the data analysis.

CHAPTER IV: RESULTS

In this chapter, the principal investigator presents the findings of the study, which is a secondary analysis of data obtained from the LongHerby and DHBMA cohort sequential longitudinal studies, and examines the physical activity participation of adolescents. Participants scored their physical activity participation on two distinct adolescent health behavior measures. Physical activity intensity and frequency were measured as a subscale of the Youth Risk Behavior Surveillance Survey and referred to as YRBSS physical activity in this chapter. A less specific measure of physical activity intensity and frequency was measured as a subscale of the Adolescent Lifestyle Questionnaire and is referred to as ALQ physical activity in this chapter. These physical activity subscales were analyzed as outcome measures in this study. The analysis included modifiable health-risk factors and non-modifiable demographic risk factors for physical inactivity and adolescent protective factors that, according to the modified resilience conceptual framework for this study, mitigate the effect of health-risk factors on adolescent health promotion behaviors. Conceptually, adolescent physical activity participation represents a resilience outcome and, more specifically, is an adolescent health-promoting behavior.

In the first section of this chapter, the principal investigator presents the preliminary data analysis procedures conducted in preparation for answering the research questions and analysis of the demographic characteristics of the study sample. The concluding section presents the quantitative findings related to each research question.

The research questions were:

Research Question 1: What are the sex, racial, and ethnic differences in body mass index percentiles (BMI) when the participants were in Grade 8?

Research Question 2: What are the sex, racial, and ethnic differences in physical activity, when the participants were in Grade 8?

Research Question 3: What are the sex, racial, and ethnic differences in risk factors (i.e., media use and parental physical inactivity) when the participants were in Grade 9?

Research Question 4: What are the sex, racial, and ethnic differences in protective resources (i.e., ethnic identity, health awareness, and social connectedness) when the participants were in Grade 9?

Research Question 5: What are the sex, racial, and ethnic differences in physical activity participation when the participants were in Grade 9?

Research Question 6: What is the nature of the relationships among the BMI percentiles (measured in Grade 8), physical activity participation (measured in Grade 8), and physical activity participation when the participants were in Grade 9?

Research Question 7: Do BMI percentiles (measured in Grade 8) predict physical activity participation, when the participants were in Grade 9?

Research Question 8: Does physical activity (measured in Grade 8) predict physical activity participation when the participants were in Grade 9?

Research Question 9: What is the nature of the relationships among the risk factors, the protective resources, and physical activity participation when the participants were in Grade 9?

Research Question 10: Do the protective resources moderate the effect of the risk factors on physical activity participation when the participants were in Grade 9?

Preliminary Data Analysis

Data collected for this study were analyzed using SPSS, Version 21. Data retrieved for secondary analysis were from two longitudinal datasets collected in the southwestern U.S., as previously described. The complete participant dataset obtained exceeded the requirement for power of the analysis; therefore statistical procedures for missing data were not required. An alpha level of .05 was set a priori for all statistical analyses. Preliminary data analyses occurred in this sequence:

1. Descriptive statistics (means, standard deviations, or frequency distributions) for all variables were computed and examined.
    a. The categorical predictor variables (sex, race, and ethnicity) describe the demographic characteristics of the participants. These findings are in Table 4.1.
    b. Predictor and outcome variables (BMI percentile, parental activity, media use, ethnic identity, health awareness, social connectedness, and physical activity [YRBSS Grade 8 and 9 and ALQ]) are presented in Table 4.2.
    c. The BMI percentile frequencies are in Table 4.11.

2. Data were screened for outliers and regression assumptions.
    a. Data were screened via descriptive statistics, boxplots, histograms, stem and leaf plots, normality plots, and scatter plots.
    b. Boxplots were observed and no outliers were identified.
    c. An examination of the skewness values and a visual inspection of the frequency distributions suggested the distribution of the predictor variables were approximately normally distributed, except media use.
    d. A significant positive kurtosis was found in the media use variables (2.57 [in room], 6.17 [in home], 5.50 [outside of home]; Field, 2005). Logarithmic transformation procedures corrected the kurtosis to acceptable levels (.122, 1.26, 1.02 respectively; Field, 2005) and the transformed variables were used in subsequent analyses.
    e. All other kurtosis values were within the acceptable range for the regression analysis (≤ 1.96; Field, 2005).
3. Bivariate correlational analysis examined the relationships among the predictor variables and both physical activity participation outcomes.
    a. Dichotomous variables were dummy coded prior to use in the correlation calculations.
    b. Minority race, Hispanic ethnicity, BMI percentile, and the three transformed media use scores were not statistically significantly correlated with either of the two measures of physical activity participation. The

scatterplots were inspected for a linear relationship and were consistent with no significant correlation (see Appendix D).

c. These six predictor variables were excluded from regression analyses.

4. Multiple correlation analysis calculations among the five remaining predictor variables were examined to detect strong relationships indicating multicollinearity.

   a. Correlation coefficients among the five predictor variables (female sex, parental activity [risk factors], social connectedness, ethnic identity, and health awareness [protective resources]) were small (≤ 0.25) and did not suggest multicollinearity challenges for the regression analysis (Field, 2005).

5. Diagnostic multiple regression analyses were performed for both physical activity outcomes, to screen for regression assumptions and outliers.

   a. The assumption of independence was met. The Durbin-Watson statistic (2.0 for YRBSS and 2.1 for ALQ) suggests the residuals are not correlated (Field, 2005; Meyers et al., 2006).

   b. The assumptions of linearity and homoscedasticity were met. The scatterplot of the standardized regression residuals and predicted values appeared rectangular in shape with dots dispersed around the zero value (see Appendix E).

c. The assumption of normality was met. The histograms with bell shaped curve and probability plots of standardized residuals were approximately normally distributed.

d. The partial regression plots were screened for linearity and homoscedasticity. The scatterplots for parent activity, ethnic identity, and health awareness showed a positive linear relationship. The social connectedness partial plot appears less linear than the other predictors as the dots are somewhat concentrated toward the higher scores and appear to have a greater variance at the lower levels.

e. The preliminary case-wise diagnostics table was reviewed and no residual outliers were discovered.

f. To ensure regression equation stability, the multicollinearity statistics and diagnostics were evaluated. The tolerance values statistics were excellent and ranged from .874 to .968. The variance inflation factor (VIF) statistic did not exceed 1.14 for either outcome. These assessments suggested there were no multicollinearity challenges with these regressions (Field, 2005; Meyers et al., 2006).

Demographic Characteristics

The sample was comprised of 251 adolescents from the southwestern US. The participants were from three rural school districts and were in Grades 8 and 9 when data for this study were collected. The sample was mostly adolescents of female sex, White race, and non-Hispanic ethnicity. Demographic frequency and percentage values for the

sample (*N* = 251) are presented in Table 4.1. Ethnicity specific frequency and percentage values are presented in Table 4.2. Characteristics of the predictor and outcome variables (mean and standard deviation values, scale ranges, interpretation of the participant's status, and when the variable was measured) are presented in Table 4.3.

Table 4.1

Demographic Characteristics of the Sample Participants (N = 251)

Variable	Frequency	Percentage
Sex		
Male	110	43.8
Female	141	56.2
Race		
African American	37	14.7
American Indian/Alaskan Native	3	1.2
Asian	2	0.8
White	203	80.9
Other	6	2.4
Ethnicity		
Hispanic	112	44.6%
Non-Hispanic	139	55.4%

Table 4.2

Ethnicity Specific Frequency Distribution (N = 251)

	Hispanic (*N* = 112)		Non-Hispanic (*N* = 139)	
Race	*N*	%	*N*	%
African American	5	14	32	86
White	103	51	100	49
Other	4	36	7	64

Table 4.3

Characteristics of the Predictor and Outcome Variables (N = 251)

Variable	Mean	*SD*	Scale Range	Interpretation	When Measured
BMI Percentile	63.56	23.95	0-100	Normal weight	Grade 8
Media Use (room)	1.68	.45	1-4	Low usage	Grade 9
Media Use (home)	1.60	.43	1-4	Low usage	Grade 9
Media Use (out)	1.42	.41	1-4	Low usage	Grade 9
Parent Activity	2.27	.84	1-4	Moderately Active	Grade 9
Ethnic Identity	2.76	.59	1-4	High	Grade 9
Health Awareness	3.02	1.34	1-4	High	Grade 9
Social Connectedness	3.08	.63	1-4	High	Grade 9
Physical Activity YRBSS 8	4.75	2.27	1-8	Moderately Active	Grade 8
Physical Activity YRBSS 9	4.01	2.21	1-8	Low Active	Grade 9
Physical Activity ALQ	3.78	1.64	1-6	Active	Grade 9

Note. Higher scores = higher attributes for all variables.

Analysis of Research Questions

Research Questions 1, 2, 3, 4, 5

The statistical procedure to determine differences in two independent group means (female and male; Hispanic and non-Hispanic; minority and White) is the independent *t*-test (Munro, 2005). The assumptions of normality of the data, homogeneity of variance, and independence were discussed previously. All data were measured at the interval level except the demographics, which were categorical. After *t*-tests were computed, all Levene's tests for equality of variance were observed. Significant Levene's tests ($p \leq 0.05$) violated the assumption of homogeneity, therefore, the *t* statistics from the row labeled *equal variances not assumed* were assessed and statistically significant *t* values ($p \leq 0.05$) were reported (Munro, 2005). Non-significant Levene's tests ($p \geq 0.05$) means that the differences in the variances are equal and the assumption of homogeneity is met. Thus, the *t* statistics from the row labeled *equal variances assumed* were assessed and statistically significant *t* values ($p \leq 0.05$) were reported (Munro, 2005). Females reported significantly lower BMI percentiles and physical activity (YRBSS, Grade 8 and 9; ALQ) and higher levels of health awareness than male participants. Minority participants reported significantly higher levels of media use in their room and had a higher sense of ethnic identity than the White participants. Hispanic participants reported a higher BMI percentile and less social connectedness than the non-Hispanic participants. The statistically significant results of the independent samples *t*-tests are presented in Table 4.4, Table 4.5, and Table 4.6.

Table 4.4

Significant Differences in Means of Predictor Variables by Female (N = 141) and Male (N = 110)

Variable	Sex	*M*	*SD*	*t*	*df*	*p*
BMI Percentile	Female	60.36	23.96	-2.42	249	.016
	Male	67.25	23.40			
Health Awareness	Female	3.24	1.25	2.98	249	.003
	Male	2.74	1.41			
Physical Activity, YRBSS8	Female	4.54	2.14	-1.65	249	.100
	Male	5.01	2.40			
Physical Activity, YRBSS9	Female	3.39	2.01	-5.30	249	.001
	Male	4.80	2.20			
Physical Activity, ALQ	Female	3.49	1.63	-3.15	249	.002
	Male	4.14	1.59			

Note. $p \leq 0.05$

Table 4.5

Significant Differences in Means of Predictor Variables by Minority (N = 48) and White (N = 203)

Variable	Race	*M*	*SD*	*t*	*df*	*p*
Media Use (in room)	Minority	.26	.13	3.16	249	.002
	White	.20	.10			
Ethnic Identity	Minority	2.97	.54	2.79	249	.006
	White	2.71	.59			

Note. $p \leq 0.05$

Table 4.6

Significant Differences in Means of Predictor Variables by Hispanic (N = 112) and Non-Hispanic (N = 139)

Variable	Sex	*M*	*SD*	*t*	*df*	*p*
BMI Percentile	Hispanic	68.03	22.17	2.69	249	.008
	Non-Hispanic	59.95	24.78			
Social Connectedness	Hispanic	3.17	.54	2.07	249	.039
	Non-Hispanic	3.01	.69			

Note. $p \leq 0.05$

Because type one or type two errors may have occurred from conducting multiple *t*-test analyses to answer research questions 1-5, a correlation matrix was calculated to determine patterns between the demographic variables (sex, race, and ethnicity) and the other variables in the conceptual model (a) BMI percentile and physical activity when the participants were in Grade 8 and (b) risk factors (media use, parental activity), protective resources (ethnic identity, health awareness, social connectedness), and (c) both measures of physical activity when the participants were in Grade 9. Dichotomous variables were dummy coded prior to use in the correlation calculations. The media use variables that had been modified using the Log transformation to correct the kurtosis, were used to calculate the correlations. Eight small, but statistically significant correlations were observed between the BMI percentiles, media use, ethnic identity, health awareness, social connectedness, physical activity, and the demographic variables. Table 4.7 shows the correlation coefficients.

Table 4.7

Bivariate Correlations Among Study Variables by Sex, Race, and Ethnicity (N = 251)

Variable	Female	Minority Race	Hispanic Ethnicity
Physical Activity (YRBSS, Grade 8)	-.082	-.045	-.021
BMI Percentile	-.151*	.051	.168**
Parent Activity	-.064	-.043	.024
Media Use (in room)	.093	.197**	.023
Media Use (in home)	.078	.103	-.064
Media Use (outside the home)	.097	.085	-.110
Ethnic Identity	.055	.174**	.085
Health Awareness	.185**	.023	.021
Social Connectedness	-.018	-.039	.127*
Physical Activity (YRBSS, Grade 9)	-.318**	.075	-.086
Physical Activity (ALQ, Grade 9)	-.196**	-.006	-.099

Note. * $p \leq 0.05$, ** $p \leq 0.01$, (all 2 tailed)

Research Question 6

A correlation analysis was performed to answer Research Question 6: What is the nature of the relationships among the BMI percentiles (measured in Grade 8), physical activity participation (measured in Grade 8), and physical activity participation when the participants were in Grade 9? The BMI percentiles were not significantly related to any measure of physical activity. The BMI percentile and physical activity scatterplots were inspected for linear relationship and were consistent with no correlation (see Appendix F). Physical activity in Grade 8 had a moderate statistically significant correlation (Cohen, 1988) with physical activity in Grade 9 (YRBSS and ALQ). The two outcome

measures of physical activity (YRBSS and ALQ) showed a strong statistically significant correlation (Cohen, 1988). The numerical values are in Table 4.8.

Table 4.8

Correlations Among BMI Percentiles, Physical Activity in Early Adolescents, and Physical Activity in Middle Adolescents (N = 251)

Variable	BMI Percentile	YRBSS, Grade 8	YRBSS, Grade 9
BMI Percentile	--		
YRBSS, Grade 8	.034	--	
YRBSS, Grade 9	.043	.431**	--
ALQ, Grade 9	-.092	.482**	.644**

Note. **$p \leq 0.01$, 2 tailed

Research Question 7

Research Question 7 was: Do BMI percentiles (measured in Grade 8) predict physical activity participation when the participants were in Grade 9? The BMI percentiles did not predict physical activity participation in Grade 9. The BMI percentiles were not statistically significantly correlated with physical activity in Grade 9 and therefore, the regression analysis was not performed. The correlation values are in Table 4.9.

Research Question 8

Research Question 8 was: Does physical activity (measured in Grade 8) predict physical activity participation when the participants were in Grade 9? Two simple linear regression analyses were performed to test if physical activity measured in Grade 8

significantly predicted physical activity in Grade 9, one for each measure of physical activity in Grade 9. Physical activity in Grade 8 predicted physical activity in Grade 9 on both measures (YRBSS and ALQ). A comparison of the results by outcome measure is in Table 4.9, followed by the analysis of the regression models.

Table 4.9

Simple Linear Regression of the Predictor Variable Physical Activity (Grade 8) on Physical Activity (Grade 9), by Outcome Measure (N = 251)

Outcome Measure	B	Std. Error	β	Significance
Physical Activity (YRBSS, Grade 9)	.420	.056	.431	< .001
Physical Activity (ALQ, Grade 9)	.349	.040	.482	< .001

Linear Regression Analysis

Physical activity outcome measured by the YRBSS inventory in Grade 9. Physical activity in Grade 8 was a significant predictor of physical activity in Grade 9. The Pearson correlation showed a robust moderately significant relationship (r = .431, $p \leq 0.01$) between YRBSS physical activity in Grade 8 and YRBSS physical activity in Grade 9. The regression model was statistically significant $F(1,249) = 56.72$, $p \leq 0.01$. The results of the regression indicate 18% of the variability in participants' physical activity participation in Grade 9 can be explained by their physical activity as measured in Grade 8. The regression coefficient was statistically significant $t(249) = 7.53$, $p \leq 0.01$.

Physical activity outcome measured by the ALQ inventory in Grade 9. The Pearson correlation showed a large moderately significant relationship (r = .482, $p \leq$ 0.01) between YRBSS physical activity in Grade 8 and ALQ physical activity in Grade 9.

The regression model was statistically significant $F(1,249) = 75.55$, $p \leq 0.01$. The results of the regression indicate approximately 23% of the variability in participants' physical activity participation in Grade 9 can be explained by their physical activity as measured in Grade 8. The regression coefficient was statistically significant $t(249) = 8.69$, $p \leq 0.01$. Physical activity in Grade 8 was a statistically significant predictor of physical activity in Grade 9.

Research Question 9

Bivariate and multiple correlational analyses performed were to answer Research Question 9: What is the nature of the relationships among the risk factors, the protective resources, and physical activity participation when the participants were in Grade 9? Previously discussed were the correlation analyses completed during the preliminary data screening process. A multiple correlation matrix examined was for relationships among all predictor variables and both physical activity participation outcomes. These correlations are in Table 4.10.

Multiple Correlation Analysis

Physical activity outcome measured by the YRBSS inventory in Grade 9. There were five statistically significant relationships among the predictor variables and YRBSS physical activity:

- A moderately inverse relationship, $r(251) = -.318$, $p \leq 0.01$ was observed between female sex (a risk factor for adolescent physical inactivity) and physical activity. Male participants engaged in higher levels of physical activity than females.

Table 4.10

Bivariate Correlations Among Risk Factors, Protective Factors, and Outcome Variables in Grade 9 (N=251)

Variable	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.
1. Female	--											
2. Minority	.001	--										
3. Hispanic	.034	-.253**	--									
4. BMI Percentile	-.151*	.051	.168**	--								
5. Log Media Use (in room)	.093	.197**	.023	.068	--							
6. Log Media Use (in home)	.078	.103	-.064	.073	.356**	--						
7. Log Media Use (outside home)	.097	.085	-.110	-.021	.374**	.392**	--					
8. Parent Activity	-.064	-.043	.024	.000	-.008	.015	.091	--				
9. Ethnic Identity	.055	.174**	.085	.045	.069	.031	.103	.071	--			
10. Social Connectedness	-.018	-.039	-.127*	.024	.030	.025	.075	.155*	.182**	--		
11. Health Awareness	.185**	.023	.021	¯.078	.095	.107	.110	¯.006	.245**	.224**	--	
12. Physical Activity YRBSS	-.318**	.075	-.086	.043	.025	-.016	.016	.248**	.126*	-.017	.173**	--
13. Physical Activity ALQ	-.196**	-.006	-.099	-.092	-.111	-.074	-.001	.165**	.219**	.139*	.346**	.644**

Note. ** $p \leq 0.01$, * $p \leq 0.05$, (all 2-tailed).

- A small positive relationship, $r(251) = .248$, $p \leq 0.01$ was observed between parental activity (a risk factor for adolescent physical inactivity) and adolescent physical activity. These results indicated that active parents had more active adolescents.
- A more robust moderately positive relationship was observed between the participants' physical activity frequency and intensity in Grade 8 and physical activity measured with the same scale in Grade 9, $r(251) = .431$, $p < 0.01$). Subsequent to this finding, a paired samples *t*-test was performed to identify the longitudinal difference in frequency of vigorous intensity physical activity between Grade 8 and Grade 9. A statistically significant difference in the means of physical activity in Grade 8 ($M = 4.75$) and Grade 9 ($M = 4.01$), $t(250) = 4.92$, $p \leq 0.01$ was observed. Adolescents engaged in vigorous intensity physical activity more frequently in Grade 8 than in Grade 9.
- A small relationship was observed between ethnic identity (a protective factor for adolescent physical activity) and physical activity, $r(251) = .126$, $p \leq 0.05$. The relationship indicated adolescents with high sense of ethnic identity tended to engage in vigorous intensity physical activity more frequently than adolescents with a low sense of ethnic identity.
- A small positive relationship was observed between the protective factor health awareness and adolescent frequency of vigorous intensity physical activity, $r(251) = .173$, $p = 0.01$. This finding indicates adolescents with high levels of health

awareness engaged in vigorous intensity physical activity more frequently than adolescents with low levels of health awareness.

Physical activity outcome measured by the ALQ inventory in Grade 9. There were two statistically significant moderate relationships among the predictor variables and ALQ physical activity:

- The correlation between physical activity in Grade 8 and ALQ physical activity in Grade 9 was robust. A positive relationship was observed, $r(251) = .482$, $p < 0.01$. Subsequent to this finding a paired samples *t*-test revealed a statistically significant difference in the means of physical activity in Grade 8 ($M = 4.75$) and Grade 9 ($M = 3.78$), $t(250) = 7.48$, $p < .001$, indicating levels of moderate and vigorous intensity physical activity were higher for adolescents in Grade 8 than in Grade 9.
- A positive relationship was observed between health awareness and adolescent moderate and vigorous intensity physical activity, $r(251) = .346$, $p \leq .001$. This finding indicates adolescents with high levels of health awareness engaged in moderate and vigorous intensity physical activity more frequently than those with low levels of health awareness.

There were four small, but statistically significant, relationships among the predictor variables and physical activity:

- An inverse relationship was observed between female sex and physical activity, $r(251) = -.196$, $p \leq 0.01$. Male participants engaged in higher levels of physical activity than females.

- A positive relationship was observed between parental activity (a risk factor for adolescent physical inactivity) and adolescent physical activity, $r(251) = .165$, $p \leq 0.01$. These results indicated that active parents had more active adolescents.
- These results indicate there is an association between the child's and the parent's physical activity.
- A positive relationship was observed between ethnic identity and physical activity, $r(251) = .219$, $p \leq 0.01$. The relationship indicates adolescents with a higher sense of ethnic identity engaged in moderate and vigorous intensity physical activity more frequently than the adolescents with a lower sense of ethnic identity.
- A positive relationship was observed between social connectedness and physical activity, $r(251) = .139$, $p \leq 0.05$. The relationship indicates adolescents with higher levels of social connectedness engaged in moderate and vigorous intensity physical activity more frequently than adolescents with lower levels of social connectedness.

The participant's physical activity in Grade 9 YRBSS and ALQ showed a large significant statistical correlation, $r(251) = .644$, $p \leq 0.01$. YRBSS measured vigorous intensity physical activity and muscle strengthening and toning by number of days in the week. ALQ measured moderate and vigorous intensity physical activity by a Likert scale from 1-never to 6-always. The correlation suggests that the participants' responses on the two scales were consistent.

Research Question 10

Hierarchical multiple regression analyses performed were to answer Research Question 10: Do the protective resources moderate the effect of the risk factors on physical activity participation when the participants were in Grade 9? This analysis was preceded by data screening for outliers, assumptions and violations, and a correlational analysis among the risk factors, protective resources, and physical activity. Those findings have been discussed. The protective resource social connectedness did not demonstrate a significant statistical correlation with physical activity (YRBSS) and was excluded from that regression analysis. The correlation coefficients between the protective resources and physical activity are in Table 4.9. All continuous predictor variables were centered in preparation for computing the interaction terms and completing the regression analyses.

Moderating interaction terms. The risk factors for adolescent physical inactivity and the health-promoting protective resources represented in the moderating conceptual model were all empirically-based variables. The strength of the relationships between the risk factors and each measure of adolescent physical activity were potentially buffered through moderation by higher levels of the health-promoting protective resources. Risk factors having statistically significant bivariate correlations with the outcome variables were included in the computation of interaction terms. Female sex, a risk factor, was significantly negatively correlated with YRBSS physical activity in Grade 9 (r = -.318, $p \leq 0.01$) and ALQ physical activity in Grade 9 (r = -.196, $p \leq 0.01$). Additionally, parental activity, a risk factor, was significantly and positively correlated with YRBSS physical

activity in Grade 9 (r = .248, $p \leq 0.01$) and ALQ physical activity in Grade 9 (r = .165, $p \leq 0.01$). The continuous protective resource variables were dichotomized at the median value to the highest value of responses, to represent higher levels of health awareness, ethnic identity, and social connectedness. Moderating variables between the risk factors for adolescent physical inactivity and each protective resource were computed. Hierarchical multiple regression analyses were used to assess for significant threshold interaction effects of the moderating variables (Kenny, 2014).

There were no statistically significant risk and protective interaction effects observed with the YRBSS outcome variable. For the ALQ physical activity outcome, the interaction term between parent activity and health awareness was the only significant risk and protective interaction observed ($R^{2\Delta}$ = 0.17, p = .027) for that outcome. The remaining computed interaction terms were excluded from further analyses because they did not demonstrate statistical significance.

Hierarchical Multiple Regression Analysis

The hierarchy of variable entry was based on the conceptual model for this study. Predictor variables (risk factors and protective resources) and the interaction term that was statistically significantly correlated with the ALQ outcome variable (parental activity with health awareness) were entered into the regression analyses in a sequential block method. The first entry into the regression was the non-modifiable demographic risk factor of female sex as block one alone because race and ethnicity were not significantly related to the outcome variables. The second block entered was the modifiable risk factor of parental activity alone because BMI percentile and media use were not significantly

related to the outcome variables. Then the protective resources were added into the model individually in this order: (1) social connectedness, (2) ethnic identity, and (3) health awareness. Social connectedness was not added into the YRBSS regression because it was not significantly related to that outcome variable. One statistically significant moderator interaction was observed. The interaction term between parent activity and health awareness, $F(1,247) = 13.109$, $p \leq 0.01$, was entered into the ALQ physical activity regression analysis as the last step.

The final YRBSS model explained 20% of the variance in adolescent YRBSS physical activity. All predictors made an individual significant contribution. After controlling for the non-modifiable demographic factor of female sex, parental activity explained the largest amount of variance in adolescent physical activity participation. A high sense of ethnic identity explained the least amount of variance in adolescent physical activity participation, yet reached statistical significance. The results of the YRBSS regression analyses are in Tables 4.11 and 4.12.

Table 4.11

Hierarchical Multiple Regression of Predictor Variables on YRBSS Physical Activity Grade 9 (N=251)

Variables	*B*	Std. Error	*β*	Significance
Step 1 - Female	-1.551	.256	-.349	< .001
Step 2 - Parental Activity	.585	.150	.222	< .001
Step 3 - Ethnic Identity	.283	.219	.076	.198
Step 4 - Health Awareness	.363	.097	.221	< .001

Note. Values shown are from the full model at step 4.

Table 4.12

Model Summary of Predictor Variables on YRBSS Physical Activity Grade 9 (N = 251)

Model	*R*	R^2	Adjusted R^2	$R^{2\Delta}$	$\underline{F}^{\Delta}$ (df1,df2)	Sig. F^{Δ}
1	.318[a]	.101	.098	.101	28.08 (1,249)	< .001
2	.392[b]	.153	.147	.052	15.24 (1,248)	< .001
3	.412[c]	.170	.159	.016	4.81 (1,247)	.029
4	.462[d]	.214	.201	.044	13.85 (1,246)	< .001

Note. [a] Predictors: (Constant), Female
[b] Predictors: Constant, Female, Parental Activity
[c] Predictors: (Constant), Female, Parental Activity, Ethnic Identity
[d] Predictors: (Constant), Female, Parental Activity, Ethnic Identity, Health Awareness
[e] Dependent Variable: YRBSS Physical Activity Grade 9

The final ALQ model explained 21% of the variance in adolescent ALQ physical activity. Health awareness and ethnic identity made the most significant predictions. Female sex and parental activity were statistically significant predictors but made very small individual contributions to the variance. Parental activity explained the least amount of variance in adolescent physical activity participation as measured by the ALQ. The interaction between parental activity and health awareness did not significantly contribute to the model. Additionally, social connectedness was not a statistically significant predictor. The remainder of the predictor variables made individual contributions to the variance in adolescent physical activity. The results of the hierarchical regression ALQ physical activity are presented in Tables 4.13 and 4.14. These are followed by Table 4.15 that shows the percentage of variance explained for each of the predictor variables.

Table 4.13

Hierarchical Multiple Regression of Predictor Variables on ALQ Physical Activity Grade 9 (N = 251)

Step	Variables	*B*	Std. Error	*β*	Significance
1	Female	-.858	.189	-.260	< .001
2	Parental Activity	.170	.202	.087	.402
3	Social Connectedness	.023	.153	.009	.879
4	Ethnic Identity	.381	.164	.137	.021
5	Health Awareness	.379	.125	.310	.003
6	Parental Activity by Health Awareness	.050	.082	.080	.539

Note. Values shown are from the full model at step 6.

Table 4.14

Model Summary of Predictor Variables on ALQ Physical Activity Grade 9 (N = 251)

Model	*R*	R^2	Adjusted R^2	$R^{2\Delta}$	$\underline{F}^{\Delta}$ (df1,df2)	Sig. F^{Δ}
1	.196[a]	.038	.035	.038	9.94 (1,249)	.002
2	.248[b]	.062	.054	.023	6.14 (1,248)	.014
3	.273[c]	.074	.063	.013	3.41 (1,247)	.066
4	.340[d]	.116	.101	.041	11.46 (1,246)	.001
5	.479[e]	.229	.214	.114	36.13 (1,245)	.000
6	.480[f]	.230	.212	.001	.379(1,244)	.539

Note. [a] Predictors: (Constant), Female
[b] Predictors: (Constant), Female, Parental Activity
[c] Predictors: (Constant), Female, Parental Activity, Social Connectedness
[d] Predictors: (Constant), Female, Parental Activity, Social Connectedness, Ethnic Identity
[e] Predictors: (Constant), Female, Parental Activity, Social Connectedness, Ethnic Identity, Health Awareness
[f] Predictors: (Constant), Female, Parental Activity, Social Connectedness, Ethnic Identity, Health Awareness, Interaction
[g] Dependent Variable: ALQ Physical Activity Grade 9

Table 4.15

Comparison of Variance Percentages by Predictor Variables

Outcome Variables	YRBSS physical activity	ALQ physical activity
Predictor Variables: (per order of entry)	Variance %	
Female Sex	10	3.5
Parent Activity	5	2
Social Connectedness	Excluded	Not significant
Ethnic Identity	1	4
Health Awareness	4	11
Interaction Term	Excluded	Not significant

Additional Analysis

There was a considerable longitudinal decline in physical activity means observed from Grade 8 to Grade 9 as measured by the YRBSS scale. Overall, there was approximately a 16% decrease in the frequency and intensity of adolescent physical activity participation. A decline in vigorous intensity (vig) and moderate intensity (mod) physical activity was markedly noted in females (26% vig, 20% mod) and Hispanics (20% vig, 24% mod). White race adolescents (16% vig, 20% muscle) showed higher percentage declines in vigorous intensity physical activity and muscle toning and strengthening (muscle) compared to minority races (10% vig, 2% muscle). Minority race adolescents had a slightly higher decline in moderate intensity physical activity than White race adolescents.

Participants' BMI percentiles were calculated from self-reports of height, weight, and date of birth when participants were in Grade 8. The majority of the participants were

normal weight but 25.1% were overweight and obese. The majority of the overweight and obese adolescents were males, Hispanic ethnicity, and White race. Shown in Table 4.16 are the frequency and percentage of each BMI percentile category by demographic characteristic.

Table 4.16

Body Mass Index of the Sample Participants (N = 251)

Classification	Underweight		Normal Weight		Overweight		Obese		Total
	N	%	N	%	N	%	N	%	N
Frequency	2	0.8	186	74.1	37	14.7	26	10.4	251
Female	2	100	111	59.7	16	43.2	12	46.2	141
Male	0	0	75	40.3	21	56.8	14	53.8	110
Hispanic	1	50	76	40.9	21	56.8	14	53.8	112
Non-Hispanic	1	50	110	59.1	16	43.2	12	46.2	139
Minority Race	1	50	33	17.7	8	21.6	6	23.1	48
White	1	50	153	82.3	29	78.4	20	76.9	203

Summary

In this chapter, the principal investigator presented the results of the research study that was anchored by a modified resilience framework. The principal investigator analyzed cross-sections of extant data retrieved from the longitudinal LongHerby and DHBMA databases. The health-promoting outcome measured for this study was

adolescent physical activity participation. Also examined were risk factors contributing to physical inactivity and protective resources contributing to health-promoting behaviors.

Correlational analyses between the predictor variables (risk factors, protective resources) and the outcome variables revealed there were nine significant relationships. The risk factors female sex and parental activity related to both measures of physical activity outcomes (YRBSS and ALQ) with females having an inverse relationship with both outcomes. The protective resources health awareness and ethnic identity were significantly related to both outcome variables. Social connectedness related significantly only to the ALQ physical activity outcome.

Hierarchical multiple regression analyses completed were for the Grade 9 YRBSS and ALQ physical activity outcome variables. The models explained 20% and 21% of the variance in adolescent physical activity practices, respectively. All of the predictors in the YRBSS model made significant individual contributions to the model with female sex explaining the largest proportion of the variance ($R^{2\Delta} = .101$, $p \leq .001$). In the ALQ model health awareness made the most significant prediction of adolescent physical activity ($R^{2\Delta} = .114$, $p \leq .001$). The moderating variable did not significantly contribute to the ALQ model.

In Chapter 5, the principal investigator presents a summary of the study, discussion, and interpretation of findings. Presented also are conclusions and implications from the study.

CHAPTER V: SUMMARY AND RECOMMENDATIONS

In this chapter, the principal investigator presents a summary of the study, compares the findings with previous studies, and discusses how the findings relate to theory. A discussion of the relationships between the risk factors and protective resources on adolescent physical activity is included. The chapter concludes with recommendations for nursing and future research.

Summary of the Study

The purposes of this descriptive, correlational study were to (a) describe modifiable risk factors for adolescent physical inactivity (body mass index, media use, and parental activity); (b) describe the protective resources (sense of ethnic identity, health awareness, and social connectedness) that promote health behaviors, specifically, physical activity participation; (c) examine the relationships among the risk factors, protective resources, and adolescent physical activity participation; and (d) determine if there is a moderating relationship between the protective resources and risk factors. The study included 10 research questions:

1. What are the sex, racial, and ethnic differences in body mass index percentiles (BMI) when the participants were in Grade 8?
2. What are the sex, racial, and ethnic differences in physical activity, when the participants were in Grade 8?
3. What are the sex, racial, and ethnic differences in risk factors (i.e., media use and parental physical inactivity) when the participants were in Grade 9?

4. What are the sex, racial, and ethnic differences in protective resources (i.e., ethnic identity, health awareness, and social connectedness) when the participants were in Grade 9?
5. What are the sex, racial, and ethnic differences in physical activity participation when the participants were in Grade 9?
6. What is the nature of the relationships among the BMI percentiles (measured in Grade 8), physical activity participation measured in Grade 8, and physical activity participation measured in Grade 9?
7. Do BMI percentiles (measured in Grade 8) predict physical activity participation, when the participants were in Grade 9?
8. Does physical activity (measured in Grade 8) predict physical activity participation when the participants were in Grade 9?
9. What is the nature of the relationships among the risk factors, the protective resources, and physical activity participation when the participants were in Grade 9?
10. Do the protective resources moderate the effect of the risk factors on physical activity participation when the participants were in Grade 9?

Conceptual Framework

The conceptual model for adolescent physical activity participation developed for this study was built upon research synthesized from a variety of disciplines, and is an adaptation of the model presented by Rew and Horner (2003), which framed the parent DHBMA study. The theory-based resilience model illustrates (a) risk factors for physical

inactivity, (b) protective resources for physical activity participation, and (c) physical activity participation as the health promoting outcome behavior that represents a resilience trajectory.

The conceptual model is described in Chapter One (see Figure 1). Female sex, minority race, and Hispanic ethnicity represent the non-modifiable risk factors whereas elevated BMI percentiles, excessive media use, and parental physical inactivity represent risk factors that are amenable to change. All risk factors are empirically associated with physical inactivity in adolescents. The protective resource variables (ethnic identity, health awareness, and social connectedness) were proposed moderators between health risk practices and adolescent physical activity (Bernat & Resnick, 2009; Love et al., 2006; Nasim et al., 2007; Wharf-Higgins et al., 2009; Youngblade et al., 2007). Conceptually, the frequency and intensity of adolescent physical activity participation represents a resilience outcome and, more specifically, is an adolescent health-promoting behavior.

Procedures

The principal investigator used a descriptive, correlational design in this secondary analysis of data obtained from the LongHerby and DHBMA cohort sequential longitudinal studies. Statistical power analysis for the multiple regression analysis consisted of (a) significance criterion, α (p = .05); (b) medium effect size, for multiple regression, (R^2 = 0.15); (c) power, 1-β (.80); and (d) sample size (N = 110).

The sample was comprised of 251 adolescents with complete data, from Grade 8 and Grade 9. Adolescent participants and at least one parent completed surveys that

included measures assessing the risk factors, protective resources, and outcome variables. The cross-sections of existing longitudinal data analyzed for this study reflects diversity among the sex, race, and ethnicity of the participants; data were collected when the participants were in Grades 8 and 9. Parent data were collected when adolescent participants were in Grade 9. A summary of the instruments used to measure the variables in this study are in Table 3.1. The principal investigator used SPSS, Version 21 to analyze data collected for this study. Descriptive statistics (frequencies and means), Pearson correlations, and hierarchical multiple regressions were used to answer the research questions.

Discussion of Findings

The principal investigator presents a summary and discussion of the findings in this section. The section begins with the demographic sample characteristics and then is organized by relevant concepts addressed in the conceptual model and research questions.

Demographic Sample Characteristics

The sample was comprised of adolescents (N = 251) from the southwestern US. The participants came from three rural school districts considered economically disadvantaged. The sample was comprised mostly of adolescent females (56%), non-Hispanic ethnicity (55%), and White race (81%). Although the State of Texas participates in data collection for the YRBSS; demographic data for the State sample are unpublished. The demographic characteristics of this sample differ from longitudinal nationally representative samples of adolescents. For example, in an examination of physical activity trends in adolescents, Gordon-Larsen, Nelson, and Popkin (2004) reported a

sample that was 47% female, 69% of White race, and 12% of Hispanic ethnicity in the National Longitudinal Study of Adolescent Health. Therefore, the results of this study are not generalizable to the U.S. population, but do positively add to the body of literature on adolescent physical activity.

Findings from the *t*-tests

Research questions 1-5 were answered using *t*-tests. Females reported significantly lower levels of BMI percentiles and physical activity (YRBSS, Grade 8 and 9; ALQ) and higher levels of health awareness than male participants. Minority participants reported significantly higher levels of media use in their room and had a higher sense of ethnic identity than the White participants. Hispanic participants reported higher BMI percentiles and less social connectedness than the non-Hispanic participants. These findings will be discussed with the correlational analyses.

After Bonferroni corrections were made to account for the number of *t*-tests being performed there were only two variables that demonstrated a significant difference in means. Females had significantly lower levels of physical activity than males as measured by the YRBSS, Grade 9 ($p < .001$). This finding was expected and is congruent with previous research (Barnett et al., 2008; Butte et al., 2007; CDC, 2010b; Coble & Rhodes, 2006; Davison, Werder, Trost, Baker, & Birch, 2007; Santos et al., 2005).

An additional analysis performed was a paired samples *t*-test, to determine the longitudinal difference in the frequency of vigorous intensity physical activity between Grade 8 and Grade 9. A statistically significant difference in the means was observed, indicating that levels of vigorous intensity physical activity were higher for adolescents in

Grade 8 than in Grade 9. This finding was expected as it is well documented that participation in physical activity declines with age for all races and ethnicities, especially in females (Barnett, 2008; Butte, 2007; Coble & Rhodes, 2006; Davison et al., 2007; Gordon-Larsen et al., 2004; Marshall, Gorely, & Biddle, 2006; Sallis, 2000; Santos, 2005).

Findings from Correlational Analyses

Multivariate correlation analyses completed during the preliminary regression data screening process were to answer Research Questions 6 and 9. The multiple correlation matrix was examined for relationships among the predictor variables: risk factors (female sex, White race, Hispanic ethnicity, BMI percentile, media use, parental activity); protective resources (ethnic identity, health awareness, social connectedness); and both physical activity participation outcomes (YRBSS physical activity, ALQ physical activity).

The discussion, organized by variables presented in the conceptual model, begins with the outcome variable, physical activity (YRBSS and ALQ). Statistically significant demographic correlations are included in the discussion.

Outcome variable – Physical activity. Table 4.8 showed the reported means for physical activity in this study. The YRBSS physical activity mean for Grade 8 (*M* = 4.75, *Range* = 1-8 or 0-7 days per week) indicates adolescent physical activity approached moderate frequency. The YRBSS mean for Grade 9 (*M* = 4.00, *Range* = 1-8 or 0-7 days per week) reveals a decrease in frequency to three days per week. ALQ (*M* = 3.78, *Range* = 1-6) measurement indicates the adolescents "often" participated in exercise or sports

three days per week. Participants in this sample were not inactive teens, but rather they participated in nearly moderate frequency physical activity in Grade 8 and had begun the descent toward low-active status in Grade 9. Results of *t*-tests presented in chapter 4 also showed that participant physical activity was higher in Grade 8 than Grade 9. These findings are consistent with published research (CDC, 2011c; Gordon-Larsen et al., 2004; Nader, 2008; Sallis, Prochaska, & Taylor, 2000). Decline in adolescent physical activity seems to be a universal phenomenon that begins in childhood and persists into adulthood (WHO, 2014). Additionally, in this sample of adolescents the activity decline may be related to several factors including (a) low or no access to recreational resources such as walking or biking trails and SES, as the participants lived in a rural area and attended economically disadvantaged schools; (b) developmental adjustments, such as low physical and activity self-concepts and competence (not measured in this study); or (c) displacement of physical activities with sedentary peer activities such as media use.

Female sex (n = 141) was the only demographic variable demonstrating a statistically significant association with the outcome variable physical activity, in Grade 9 (YRBSS physical activity, Grade 9 [r = -318, p < .001], and ALQ physical activity [r = -.196, p = .002]). This means males (n = 110) in the sample had higher levels of physical activity than the female participants, using both measures of physical activity. This finding supports the *t*-test result that male participants reported higher levels of physical activity than the female participants and corresponds with the research that established the level of participation in physical activity steadily declines through adolescence, especially in girls (CDC, 2011c; Nader, 2008).

Nationwide, only 15.3% of high school students met the HP 2020 objective for aerobic activity (CDC, 2011c) and this value has decreased from previous YRBSS findings (18.4% in 2009; CDC, 2013). Results from the national YRBSS study identified adolescent males in Grades 9-12 reported higher levels of physical activity (21.9%) compared with female (8.4%) students. Additionally, the prevalence of both aerobic and muscle-strengthening activities was lower among female students, students in upper grades, and students with obesity (CDC, 2011c). In this study, the relationship between female sex and YRBSS physical activity in Grade 8 was inversely, but not statistically significantly related (r = -.104, p = .100). Moreover, vigorous intensity and moderate intensity physical activity in females declined by 26% and 20% respectively, from Grade 8 to Grade 9 (YRBSS), in this study. The longitudinal decrease in female physical activity found in this study is consistent with national data (CDC, 2011c; Gordon-Larsen et al., 2004; Nader, 2008) and underpins the necessity to improve the physical activity levels of female adolescents.

Corroborated by other research findings is the inverse correlation between female sex and physical activity (YRBSS and ALQ). Comparing active and non-active adolescents, Santos et al. (2005) reported female adolescents participated in significantly less moderate intensity and overall less frequent physical activity than males. Several other studies reported adolescent boys were more active than girls (Barnett et al., 2008; Butte et al., 2007; Coble & Rhodes, 2006). Wilson (2009) found declining physical activity is particularly evident among girls of lower socioeconomic status. Participants in

this study attended schools considered economically disadvantaged, which supports Wilson's findings.

In this study, the principal investigator did not address childhood developmental factors, but because movement skills are antecedent to adolescent participation in physical activity; childhood developmental factors are addressed briefly. Longitudinal findings from Barnett et al. (2008) support the assertion that female adolescents have an inverse relationship with physical activity participation and suggest motor skill proficiency as a child influences adolescent engagement in physical activity. Developmentally, adolescents who established strong fundamental movement and object control skills in childhood were more likely to possess a positive self-concept of movement that leads to being more physically active in adolescence (Wrotniak, Epstein, Dorn, Jones, & Kondilis, 2006). Most importantly, a positive movement self-concept is greater in boys than girls and such, is antecedent to the mastery of more advanced movement skills, leading to participation in physical activity throughout adolescence and adulthood (Allison et al., 2005; Bornholt & Piccolo, 2005; Okely, Booth, & Patterson, 2001a;). For females, it is possible the low physical activity is in part due to having poor movement skills or low self-concept of movement. Also, participants could have experienced multiple competing demands for their time such as homework and jobs, or lack time management skills.

Risk factor – Body mass index. The average BMI percentile in this study was 63.55 (*SD* = 23.95), which is normal weight. The demographic variables associated with BMI percentiles in this study were female sex (r = -.151, p = .016) and Hispanic ethnicity

(r = .168, p = .008). The highest percentages of participants with overweight and obesity in this study were males (56.8% and 53.8% compared to females), Hispanics (56.8% and 53.8% compared to non-Hispanics), and White race (78.4% and 76.9% compared to minority race adolescents). Possibly, the higher prevalence of overweight and obesity of the White adolescents in this study is related to the 4:1 proportion of participants who self-reported White race over a minority race, as Hispanics often report as White race.

Height and weight data were collected in early adolescence (Grade 8) as part of the LongHerby study. The majority of the participants in this study reported height and weight data within a normal BMI percentile range (n = 186, 74%) but approximately one quarter of this sample was overweight (15%) or obese (10%). Classified as underweight were two participants, meaning their BMI percentile was below five. Adolescents are considered overweight when their BMI ranges between the 85th to 94th percentile for sex and age, while obese when the BMI reaches the 95th percentile and above, for sex and age (CDC, 2011a).

The prevalence of overweight and obesity of the adolescent participants in this study were similar to national trends. Child and adolescent obesity prevalence is monitored through three large national databases: (1) National Health and Nutrition Examination Survey (NHANES), (2) Youth Risk Behavior Surveillance System (YRBSS), and (3) National Longitudinal Study of Adolescent Health (Add Health). The adolescent BMI percentile values from NHANES, which are calculated with measured heights and weights indicates that 18.4% of U.S. adolescents aged 12-19 years are obese. The most significant increase in obesity rates over the past 10 years were noted in

Hispanic males (Fryar, Carroll, & Ogden, 2012), which is consistent with the sample in this study. Calculated from self-reported heights and weights, the YRBSS provides data collected during the middle adolescent phase, in Grades 9-12. Recent analysis of YRBSS data revealed overweight (15.2%) and obesity (13%) rates of U.S. adolescents in high school totaled 28.2% (CDC, 2013), which is very similar to the sample in this study. Add Health data captured a longitudinal BMI percentile trend that indicated Hispanic females were at high risk for adolescent obesity incidence and chronic obesity through middle adulthood (Gordon-Larsen, The, & Adair, 2010). Stovitz, Schwimmer, Martinez, and Story (2008) analyzed data from all three of these large, nationally representative U.S. databases and determined adolescent Hispanic males are the sex and ethnic group at greatest risk for obesity incidence that chronically persists through adulthood. Based on these findings it is possible that male and female Hispanic adolescents should receive obesity prevention education.

BMI percentiles are the recommended measure for identifying overweight and obesity in children and adolescents (Dietz et al., 2009). Data for calculating BMI percentiles in this study were self-reported heights and weights, collected from early adolescents, in Grade 8. Brener et al. (2003) conducted a validity study on self-reported height and weight measurements. When compared to objective height and weight measurements they determined BMI percentiles calculated from self-reported data values were valid and reliable. The prevalence of adolescent overweight and obesity with self-report measures is underestimated; students tend to over report their height and under report their weight (Brener et al., 2003). While the overweight and obesity prevalence of

this sample is already of urgent concern, it is possible the prevalence may be higher than actually reported. These findings suggest health promotion efforts toward increasing participation in physical activity for adolescents residing in economically disadvantaged and rural areas are crucial.

Risk factor – Media use. The media use scale consisted of three subscales. Adolescents reported low usage of overall media daily. The means were: in their room at home (*M* = 1.68; *Range* = 1-4), in home but not in their room (*M* = 1.60; *Range* = 1-4), and outside of the home (*M* = 1.42; *Range* = 1-4). Significant positive kurtosis was found for each subscale indicating that the majority of values assigned to media use by the participants were low usage scores. Logarithmic transformation procedures corrected the kurtosis to acceptable levels and the principal investigator used the transformed variables in the correlation analysis. The transformed media use variables were not correlated to either physical activity outcome variable and were excluded from regression analyses.

This finding regarding low media use was unexpected as some literature suggests that children frequently displace time doing physical activity with inactive activities such as media use (Graham, Schneider, & Cooper, 2008; Lutfiyya et al., 2008). Adolescents, regardless of age, sex, race, or ethnicity typically find inactive activities, such as playing video games, computer use, and television viewing (media use), enjoyable discretionary-time activities (Dietz & Gortmaker, 2001; Marshall, Gorely, & Biddle, 2006). Tracking media use over a 10-year period (1999-2009) revealed that 24.9% of American adolescents engaged in leisure time computer use while 32.8% of American adolescents engaged in leisure time television viewing, both for more than three hours per day (CDC,

2010d). Media use was a risk factor for adolescent physical inactivity in the conceptual model.

Each media use subscale was correlated with the other media use variables but there was only one additional correlation found. Media use in one's room at home was positively correlated to minority race (r = .197, p = .002). African American and Asian American males logged the most hours in media use (Carlson et al., 2010; Utter, Neumark-Sztainer, Jeffery, & Story, 2003), while Butte et al. (2007) determined Latinos demonstrated a significant relationship between the hours watching television and playing video games, with elevated BMI percentiles. Lutfiyya et al. (2008) established that obese African American children spent more time watching television and in non-school related computer use than their obese Hispanic and Caucasian peers. The correlation between media use in one's room at home is consistent with previous findings.

Risk factor – Parental activity. The reported mean for parental activity was 2.27 (*range* = 1-4), meaning the parents activity level was just slightly above the mid-range value. Parental activity was not statistically correlated with demographic factors but was associated with both outcome measures (r = .248, p = .001 [YRBSS] and r = .165, $p \leq$ .001[ALQ]). This finding suggests that higher parent activity is associated with higher adolescent activity and is congruent with a number of other studies that suggest a positive relationship between parental and adolescent physical activity (Madsen, 2009; Ornelas, Perreira, & Ayala, 2007). Parents do play a key role in modeling and socializing their children into an active lifestyle. This finding is supported by Pugliese and Tinsleys'

(2007) meta-analysis, which showed a strong moderate and positive association between parental modeling and adolescent physical activity during middle and late adolescence. As for low active parents, Terzian and Moore (2009) found an association with adolescents who did not exercise and were more overweight.

Parents and youth participating in a multi-family focus group identified parental modeling as a very important strategy in helping their adolescents be more active (Berge et al., 2012). In a longitudinal examination, Madsen (2009) concluded that adolescents' perception of parental physical activity predicted girls' physical activity levels throughout adolescence, and remained stable despite developmental influences. Similarly, parents participating in a focus group suggested role modeling an active lifestyle would improve their children's activity level (Moore et al., 2010) and Kahn et al. (2008) found maternal physical activity was positively associated with adolescent participation in physical activity.

Protective factor – Ethnic identity (EI). EI is an aspect of identity development related to one's membership in an ethnic group and results in how individuals view themselves relative to the ethnic group (Greig, 2003). Adolescents in this study reported a high sense of EI (M = 2.76, *Range* = 1-4). Minority adolescents experience a parallel growth in self-esteem as EI develops (Jones & Galliher, 2007; Juang et al., 2006; Phinney & Rosenthal, 1992; Umana-Taylor et al., 2009) and positive self-perceptions are correlated with adolescent participation in and adherence to regular physical activity (Colchico, Zybert, & Basch, 2000).

Minority race and EI showed a statistically significant relationship (r = .174, p = .006). This means the minority race participants had a higher sense of ethnic identity than White race participants. This finding was expected as EI is a normative construct, with steps similar to achieving the adolescent psychosocial task of ego identity development, especially for minority race and Hispanic adolescents (Chao & Otsuki-Clutter, 2011). Some researchers posit that the EI development of single race White, non-Hispanic adolescents is somewhat inherent and different from their minority race and Hispanic counterparts because they grow up within the context of the majority race and ethnicity in the United States (Greig, 2003; Perron,_Vondracek, Skorikov, Tremblay, & Corbière, 1998; Phinney & Alipuria, 1990; U.S. Census Bureau, 2011). Countering this notion, Yip (2014) found EI development, within the context of significance and salience, did not differ between White and minority race adolescents.

EI was positively associated with both measures of physical activity (r = .126, p = .046 [YRBSS]); (r = .219, $p \leq .001$[ALQ]). Yet, multi-disciplinary literature databases are relatively devoid of studies exploring the association of EI with adolescent physical activity. No studies were located presenting EI in the interaction role of promoting physical activity in adolescents. It is, however, established that a strong sense of EI serves in a protective role to promote health and well-being in adolescents (Smith & Silva, 2011). For example, Love et al. (2006) found a strong EI was related to the reduction in alcohol, substance, and cigarette use in Mexican American youth. Austin (2004) found an inverse relationship between EI and violent behavior and suggested that EI is an important resilience factor.

EI, examined with physical activity in adult populations, was a predictor of physical activity in a sample of Black mid-life females (Hardy et al., 2007). Albright et al. (2012) conducted an intervention study focused on increasing physical activity in a sample of multi-ethnic post-partum mothers by targeting EI. Interventional studies targeting the development of, or strengthening adolescent EI in all races and ethnicities may serve to improve physical activity in adolescents. Parent, family, and generational EI and acculturation status of minority and Hispanic adolescents are other important topics to explore in relation to the role of EI as a protective resource, for adolescent health promotion.

Protective factor – Health awareness. Health awareness is the adolescent's increasing knowledge and perception of personal health status, through education and consultation with others (Gillis, 1997). Adolescents in this study reported a moderate level of health awareness (M = 3.02, *Range* = 1-6). Female sex was positively related to health awareness (r = .185, p = .003). Newell-Withrow (1986) found girls sought health information significantly more than adolescent boys. Building on that finding, Callaghan (2006) found adolescent females not only scored higher than adolescent males in the area of information seeking, but also in their health knowledge and health responsibility, while concluding females were more confident in their ability to practice healthy behaviors. Bayne-Smith et al. (2004) presented an example of a multi-racial and ethnic group of adolescent girls who successfully translated health awareness and health knowledge into a health promotion practice through purposeful engagement in daily physical activity.

The current study did not assess adolescent health knowledge or responsibility. Since there was a negative relationship between female sex and physical activity, further study is warranted about the relationship between seeking health information and translation of that information into health knowledge and healthy behaviors such as physical activity. Developmentally, translation of health information into health knowledge, health knowledge into awareness of good health practices, and subsequent health-promoting behaviors is a process that occurs individually, along the spectrum of adolescence (Regbar & Kelly, 2007; Sanders et al., 2009). Thus, future research might include specific factors that facilitate translation of health information into healthy behaviors. Important developmental factors to consider are decision-making, self-efficacy, competence, and personal agency toward physical activity. Health information literacy is another prime area for future investigations, possibly addressing health information literacy in school health education classes.

Health-awareness was positively associated with both physical activity outcome measures (r = .173, p = .006 [YRBSS]); (r = .346, $p \leq .001$ [ALQ]). Previously discussed were the relationships between female sex and physical activity, and female sex and health awareness. The literature associating health awareness and physical activity primarily focuses on interventions to improve female adolescent physical activity frequency and intensity by providing after school activity programs and improving their activity self-efficacy to promote walking as exercise (DeBate et al., 2009; Fung et al., 2012; Lee et al., 2012) and health literacy (Hubbard & Rainey, 2007).

Protective factor – Social connectedness. Social connectedness implies that adolescents feel a sense of belonging and perceive they are cared for and empowered, within a given context (DiFulvio, 2011). Adolescents in this study reported a high level of social connectedness (*M* = 3.08, *Range* = 1-4). In this study, social connectedness showed a moderately weak relationship to Hispanic ethnicity (r = .127, p = .045). An earlier analysis of preliminary data found social connectedness to be a statistically significant protective factor against stress in a large sample of Hispanic (51%) pre-adolescents (Taxis, Rew, Jackson, Kouzekanan & Hayes, 2004). The sample Taxis et al. (2004) described participated in the LongHerby study that preceded DHBMA. Some of the participants in the present study may have been included in Taxis et al.'s (2004) study when they were pre-adolescents. Hypothetically, it is possible that social connectedness served as a longitudinal protective factor for health-promoting behaviors among a subset of participants in this study. However, longitudinal social connectedness was not investigated in this study.

Social connectedness was also statistically significantly related to ALQ physical activity (r = .139, p = .028), but not to the YRBSS physical activity outcome. Published research positively associates social connectedness and physical activity, across the lifespan. Yang, Tan, and Cheng (2014) reported community connectedness increased adolescents' (White and Asian American) odds of engaging in physical activity. Positive associations found were between social connectedness and physical activity in a multi-ethnic adult sample (Wen, Kandula, & Lauderdale, 2007) and a sample of adult males (Dunlop & Beauchamp, 2013). Social connection and interactions within meaningful,

caring relationships are a critical resource in protecting adolescents from adverse and potentially harmful health outcomes (Henrich et al., 2005; Resnick et al., 1993). It is important this construct be further investigated in promoting adolescent health behaviors, such as physical activity.

Findings from Linear Regression Analyses

Correlations between BMI percentiles and physical activity (YRBSS) measured in Grade 8 and physical activity measured in Grade 9 (YRBSS and ALQ) were calculated to answer Research Question 6. Research Questions 7 and 8 investigated the predictive relationship between these variables.

BMI percentiles and physical activity. There were no statistically significant correlations between BMI percentiles and any of the three physical activity outcomes (YRBSS Grade 8 and 9 or ALQ). An inverse relationship between these variables was anticipated because higher BMI percentiles are a modifiable risk factor for adolescent physical inactivity (Rowland, 1999). The expected correlation between BMI percentiles and physical activity may have been lessened since the majority of the participants in this study had a BMI range (n = 186, 74%) considered normal weight and correlations require variability in the data. Therefore, these results are not consistent with Hwang and Kim (2011) who concluded that overweight and obese adolescents are significantly less physically active and spend less time in physical activity than their normal weight peers. Additionally, obese adolescents were the least likely group to achieve even moderate levels of physical activity (Lutfiyaa et al., 2008) and low active adolescents in middle school and high school were most likely to be obese, compared to the moderately active

teens (Hohensee & Nies, 2012). The majority of inactive adolescents are older girls (Terzian & Moore, 2009) and inactive girls have approximately twice the odds of being overweight as their moderately active female counterparts (Hohensee & Nies, 2012). However, this study did support the finding between female inactivity and overweight BMI, reported by Hohensee and Nies (2012).

Physical activity – Grade 8; Physical activity – Grade 9. Physical activity measured in Grade 8 demonstrated a statistically significant association with physical activity measured in Grade 9. The simple linear regression analysis indicated 20% (YRBSS, $p \leq 0.01$) and 21% (ALQ, $p \leq 0.01$) of the variances in Grade 9 physical activity levels of adolescents in this sample were explained by physical activity levels in Grade 8. Much evidence suggests there is a longitudinal predictive relationship in adolescents for physical activity (Hearst, Patnode, Sirard, Farbaskh, & Lytle, 2011; Hwang & Kim, 2011; Tammelin, 2005). Hearst et al. (2011) emphasized the strongest predictor of adequate longitudinal physical activity levels during adolescence is the baseline level achieved during pre- or early adolescence and that is supported by this study.

Findings from Hierarchical Regression Analyses

YRBSS. There were no statistically significant correlations between BMI percentiles, minority race, Hispanic ethnicity, or the three transformed media use variables and YRBSS physical activity and therefore they were excluded from the regression analyses. The multiple regression analysis indicated 20% of the variance in YRBSS physical activity was explained by variables in the conceptual model ($p \leq .05$).

The non-modifiable demographic risk factor (female sex) explained 10% of the variance and the modifiable risk factor (parental activity) explained 5% of the variance. Other variables that explained statistically significant amounts of the variance in YRBSS physical activity were ethnic identity (1%, $p = .029$) and health awareness (4%, $p = < .001$). Adolescents who were (a) male, (b) had active parents, (c) reported a higher sense of EI, and (d) reported higher levels of health awareness engaged in statistically significantly higher levels of frequency and intensity of physical activity.

ALQ. There were no statistically significant correlations between BMI percentiles, minority race, Hispanic ethnicity, or the three transformed media use variables and ALQ physical activity and therefore they were excluded from the regression analyses. The multiple regression analysis indicated that 21% of the variance in YRBSS physical activity was explained by variables in the conceptual model ($p \leq .05$). The demographic variable female sex explained 3.5% of the variance and the modifiable risk factor parental activity explained 1.9% of the variance. Other variables that explained statistically significant amounts of the variance in ALQ physical activity were ethnic identity (4%, $p = .029$) and health awareness (11%, $p < .001$). Male adolescents, adolescents who had active parents, and adolescents who reported a higher sense of EI and health awareness engaged in higher levels of physical activity.

Comparison of hierarchical predictor variances. The predictor variables were entered into both models in the same hierarchy of relevance except that the ALQ model included social connectedness, entered between ethnic identity and health awareness, and one interaction term as the sixth step. Neither social connectedness nor any interaction

term showed a statistically significant relationship with the YRBSS outcome, and therefore these variables were not included in the YRBSS regression model.

Female sex accounted for the largest amount of variance in YRBSS (10%) but only 3.5% in the ALQ final model. This difference in variance percentage could be related to the specificity of the measurement scales. The YRBSS scale measured the number of days per week each participant engaged in activity whereas the ALQ measured general activity, thus offering more latitude for interpretation of responses, by the participants. Recall bias or social desirability could have affected the responses. Overall, the participants' YRBSS Grade 9 physical activity status had declined since Grade 8 toward a low active status and females demonstrated an inverse association with YRBSS physical activity in Grade 8 (not statistically significant) and Grade 9 (statistically significant). Because females are notably less active than males (Buckworth & Nigg, 2004; Coble & Rhodes, 2006; Nelson & Gorden-Larsen, 2006), this study focused on female sex as a risk factor for physical inactivity. Future investigations (of this subset of participants and other studies) should compare females and males as risk factor predictors for physical inactivity.

Health awareness accounted for the largest amount of variance in the ALQ outcome (11%) but only 4% in the YRBSS final model. The difference in these findings may be because the ALQ physical activity and health awareness scales are two related subscales of the ALQ. The ALQ was administered to participants beginning in Grade 9, so longitudinal data for this outcome measure is not available.

Social connectedness within family and school contexts were associated with self-reported positive health behaviors in Canadian adolescents (Yugo & Davidson, 2007). Regular participation in physical activity is one example of a positive health behavior that results in numerous physical and psychosocial benefits across the lifespan. Such benefits include reducing the risk of premature morbidity and mortality and improvement in depression, anxiety, and mood (Strong et al., 2005; USDHHS, 1996). It was quite unexpected to find social connectedness was not related to YRBSS physical activity in Grade 9 and was not a predictor of ALQ physical activity. Participants' scores indicated they perceived a high level of social connection within the family, school, and community. The partial residual scatterplot revealed more variance in the lower scores in social connectedness and may have been a factor in the insignificant predictive relationships with YRBSS and ALQ physical activity in this study. The data were negatively skewed consistent with the partial residual scatterplot. Further exploratory research is needed to further elucidate the effect social connectedness has on health risk and health promoting behaviors.

There was only one statistically significant interaction term between the risk factors and protective resources (parent activity x adolescent health awareness). More statistically significant interaction terms were anticipated as previous research shows the protective resources, ethnic identity, health awareness, and social connectedness as moderators of adolescent health risk or health promoting behaviors (DeBate et al., 2009; Fung et al., 2012; Lee et al., 2012; Love et al., 2006; Nasim et al., 2007; Smith & Silva, 2011; Yang et al., 2014). It is possible the selected protective resources served as

mediators for physical activity rather than moderators. Due to the individuality of development and the wide spectrum for achieving holistic maturity, age may be the best moderator of adolescent risk factors for physical inactivity in future investigations. Race and ethnicity should also be analyzed as moderators of risk factors for physical inactivity as those groups can be targeted for physical activity health promotion initiatives.

Methodological Issues

Several factors limit the findings of this study. The design of the study limits inferences about cause and effect relationships. Although the YRBSS physical activity data are longitudinal from Grade 8 to Grade 9, the risk factors, protective resources, and ALQ physical activity are a cross-section of data; therefore, resilience cannot be inferred. Since the data were from an extant database, the actual research questions asked and the precision with which the research questions were posed was limited by available data. The self-report measures might have influenced the objectivity of the findings and the adolescents' lack of accurate recall of physical activity participation might have limited validity. The non-probability sampling was not necessarily representative of the general regional race and ethnicity population and the sample did not equally stratify adolescents by sex, race, or ethnicity, therefore, the findings might not be generalizable to all geographic areas.

Only four variables (2 risk factors and 2 protective resources) in the conceptual model were associated with YRBSS adolescent physical activity whereas five variables (2 risk factors and 3 protective resources) in the conceptual model and one interaction term (parental activity by health awareness) were associated with ALQ physical activity.

Most correlations were small and only 20% (YRBSS) and 21% (ALQ) of the variance was explained by the risk and protective variables. Contrary to expectations illustrated in the conceptual model, the non-modifiable risk factors, minority race and Hispanic ethnicity, were not related to the outcome measures; nor were the modifiable risk factors BMI percentile (overweight and obese) or media use. Relative race homogeneity (White, n = 203, 80%) of the sample may have been a contributing factor to the small amount of variance (20% and 21%) explained by the variables in the conceptual model.

Theoretically, the protective resources were expected to have a greater influence on adolescent physical activity directly and indirectly through moderation of the risk factors for adolescent physical activity. Only one interaction exhibited a significant relationship to physical activity (ALQ), but it did not account for a significant amount of variance in the regression model. A review of the literature indicated there are a number of other factors that may not have been available for inclusion in the conceptual model of this secondary analysis, but are important in predicting adolescent physical activity. Factors that are potential predictors of adolescent physical activity and future research topics include developmental influences (personal agency, behavioral autonomy, formal operations, puberty), self-efficacy for movement skills and activity, SES, and environmental dynamics (neighborhood access and safety, built environment opportunities). The role of a genetic propensity toward physical activity or heritability is a growing area of research as scientists have isolated physical activity and physical inactivity phenotypes within the human genome (Vilhena e Santos, Katzmarzyk, Seabra, & Maia, 2012).

Conclusions

The conceptual model for adolescent physical activity participation developed for this study (see Figure 1) is an adaptation of the model presented by Rew and Horner (2003), which framed the parent DHBMA study. Although the model explained only a small amount of variance in adolescent physical activity participation, several conclusions may be drawn from these analyses. A combination of non-modifiable risk factors, modifiable risk factors, and protective resources were involved in the promotion of physical activity of adolescents in the sample. In this conceptual model physical activity represented a resilient outcome trajectory. Overall, the regression models using both measures of the outcome (i.e., YRBSS and ALQ) accounted for a small amount of variance. Female sex accounted for the largest amount of variance in YRBSS physical activity (10 of 20%), while health awareness accounted for the largest amount of variance in the ALQ outcome (11 of 21%). Other variables that contributed significantly to the models were parental activity (modifiable risk factor) and ethnic identity (protective resource).

Among the non-modifiable risk factors for adolescent physical inactivity, only female sex was statistically significant when correlated with the outcome variables (both) and subsequently was the most significant predictor for YRBSS physical activity. In this study, the majority of the sample was female (N = 141, 56.2%). The inverse correlation of being female with physical activity is consistent with previous studies. The majority of inactive adolescents are older girls.

Parental activity was the only modifiable risk factor that was statistically significant when correlated with physical activity. Parental activity was a significant predictor and accounted for 5% of the variance in YRBSS and 11% of the variance in ALQ physical activity. In this study, parents reported a mid-range level of physical activity with the mean falling just slightly above the midpoint (*M* = 2.27, *Range* = 1-4). The adolescent physical activity levels reported in this study also fall at the midpoint of the range in Grade 8 but fall below that level in Grade 9. Although this study did not specifically measure parental modeling, there is a positive correlation that suggests a plausible hypothesis: that parental modeling may have been a factor in this sample of adolescents and parents. Also, a genetic component (heritability) may possibly link parental activity with the activity level of their children.

Among the protective resources, health awareness was the most significant predictor of adolescent ALQ physical activity and accounted for a portion of the variance in YRBSS physical activity. This is a very important finding because developmentally, adolescence is the stage in the life course where adolescents are coming into their own; setting values, attitudes, and behaviors they will hold through adulthood. As the brain matures cognition further develops, enabling adolescents to consider critically their health and lifestyle behaviors. During this period of development behavioral autonomy is emerging. This provides nurses with a prime opportunity to provide health promotion education positively to influence the health behaviors that will be adopted, and that will persist into adulthood (Nelson, Lytle, & Pasch, 2009).

EI, correlated with both YRBSS and ALQ physical activity, was a significant predictor of both; whereas, social connectedness was statistically significant when correlated with ALQ only, but did not account for a significant portion of the variance of ALQ physical activity. A high sense of EI and social connectedness were reported by the adolescent sample. The social connectedness scale measured aspects of family, school, and community connections (caring), which theoretically should correlate with health promotion behavior such as physical activity. Although there is limited published research associating social connectedness and physical activity specifically, what is available, reports a positive relationship between the variables, across the lifespan. A gap in the adolescent literature persists; researchers need to explore the relationship between social connectedness and physical activity in adolescent samples. Finally, it is possible that social connectedness serves as a mediator between parental activity (or modeling) and adolescent physical activity or that a recursive path between these variables exists. Both notions are leading examples for future investigations.

Physical activity, measured by YRBSS from Grade 8 to Grade 9 showed significant declines in vigorous intensity activity, moderate intensity activity, and muscle strengthening across the demographic gradient. In this sample of adolescents, females reported the highest reduction in vigorous intensity activity, Hispanics showed the highest reduction in moderate intensity activity, and females and Hispanics both reported a 24% reduction in muscle strengthening.

Implications and Recommendations for Nursing Practice, Research, Education, and Public Policy

Based on the findings and conclusions of the study, several implications identified have relevance for nursing practice, research, education, and public policy.

Parent and Adolescent Activity

In this study, parental activity was a modifiable risk factor for adolescent physical inactivity, but the mean activity levels of the parents fell above the mid-value range indicating parents were not inactive or low active. Therefore, (a) nurses must consider parental activity as a protective resource and potential moderator of risk factors for adolescent physical activity and (b) nurses should focus adolescent health promotion education on the relationship between parent and adolescent physical activity. Routine health care clinic visits are an optimum time to assess parent and adolescent physical activity in order to provide education according to that information.

Pediatric health care clinics are prime locations to base or recruit for future exploratory, correlational, and interventional studies. Healthcare clinics provide an array of demographic diversity as well as being located in both urban and rural areas. Thus, researchers can deliberately target healthcare clinics for future studies, according to literature gaps and previous findings, such as the persistently low activity levels of female adolescents.

BMI

In this study, BMI percentile was a modifiable risk factor for adolescent physical inactivity but the variable was not statistically significant when correlated with either measure of adolescent physical activity. In this study, 25% of the sample was overweight

and obese. Height and weight data were by self-report. The sample drawn from rural areas was considered economically disadvantaged. In light of these facts, nurses should recall, although BMI percentiles calculated from self-reported data are valid and reliable, values are often underestimated, as students tend to over report their height and under report their weight. Obtaining objective measurements of adolescent height and weight, by trained staff, reduces BMI measurement bias in research studies. Nurses must identify adolescents at high risk for developing overweight and obesity especially in Hispanic males, those economically disadvantaged, and adolescents in rural areas.

Advanced practice nurses should screen for evidence of demographic risk factors, BMI status, and sequelae to obesity during each healthcare encounter with adolescents. Specifically, elevated BMI percentiles along with abnormalities in physiological parameters such as blood pressure and biochemical results such as lipid or glucose tests should be followed with secondary obesity prevention education. It is important that the teaching plan include adolescents in the planning process to increase adherence to the weight management strategies and facilitate lifestyle behavior changes (McAdams, 2010). Nurse researchers can specifically address BMI percentiles, hypertension, or other modifiable sequelae in future interventional studies focused on reducing the adolescent obesity epidemic.

Physical Activity

In this study, the principal investigator did not specifically investigate barriers to adolescent physical activity but there was a longitudinal decline in physical activity intensity and frequency found in this sample of adolescents. One implication drawn from

this finding is the possibility that environmental, social, personal, and economic barriers may have contributed to the decreased physical activity, over time. Although there are more than ample published investigations about adolescent physical activity, the prevalence in declining activity levels from childhood to young adulthood continues to rise. Nurses should be proactive in identifying barriers to adolescent (and parent) physical activity through deliberate interview methods. Future exploratory research should focus on identifying physical activity barriers (risk factors) and interventional research should focus on eliminating or reducing the barriers to adolescent and family physical activity participation.

Developmental Influences

It is important that nurses recognize adolescent development as a crucial aspect in physical activity behaviors. The school setting offers much potential to assess development and affect the physical activity behaviors of adolescents based on those findings. Nurses in the school environment must be innovative when developing strategies to improve adolescent physical activity participation. While accounting for the range of physical development and determining personal interests of low active or inactive adolescents, nurses can suggest a variety of energy-expending activities that are enjoyable to the students and that may facilitate energy balance (McAdams, 2010). For example, nurses are in a unique position in the school environment to introduce walking and talking trails within the current building structure. Developmental barriers to participation in physical activity are sometimes associated with low self-efficacy or competence in physical skills (Rourke et al., 2003; Rutkowski and Connelly, 2012),

especially in females. Including adolescents in planning energy-expending activities congruent with their personal physical skill sets may empower them toward improved participation in physical activity before, during, and after the school day.

The relationship between developmental factors and physical activity should be continually investigated. Researchers should focus on determining cognitive thresholds where adolescents correctly translate health education into purposefully considering and implementing healthful physical activity behaviors, autonomously. Another important developmental research focus lies in adolescent physical activity self-efficacy and developing behavioral autonomy.

Resilience

To demonstrate a resilience trajectory, it is essential to elucidate specific risk factors and protective resources related to adolescent participation in physical activity and determine if a moderating relationship exists between them. Since most of the risk factor and protective resource interactions were not statistically significant predictors of adolescent physical activity in this study, there is no evidence for a positive resilience trajectory. Physical activity participation in Grade 8 was correlated with physical activity in Grade 9, but in the absence of an interaction effect this finding also does not demonstrate a resilient trajectory for the participants of this study.

Resilience is a normal human response to risk and because of the growth and development occurring, adolescents are more vulnerable to adverse outcomes from risk than at any other time in life. It is important that the nursing profession diligently pursue improvement of adolescent physical activity as their vulnerability to obesity increases as

they age. More longitudinal studies are needed to examine other risk factors for physical inactivity and adolescent resources that protect adolescents from vulnerability toward inactivity and low active lifestyles.

Nursing Education

This study investigated adolescent physical activity as a health-promotion strategy aimed at reducing the obesity epidemic in adolescents. This study provides research evidence of a longitudinal decline in physical activity participation of adolescents. Nursing students can incorporate this finding in a literature synthesis as a basis for adolescent physical activity teaching plans. Additionally, the majority of overweight and obese participants in this study were males of Hispanic ethnicity and White race which provides a target population for primary and secondary prevention and health promotion education, to reduce the adolescent obesity epidemic.

Public Policy

Nurses can promote physical activity in adolescents by assuming leadership roles in policy development at their local school systems such as physical education and health education. Nurses can advocate for adolescents by becoming active in state legislative arenas to ensure school curriculums support physical education and health education. Additionally, nurses can advocate for individuals and communities through current legislative channels, such as introducing changes to the built environment that remove barriers to physical activity participation.

Nurses are often the gatekeepers for individuals within a community experiencing health, health promotion, or disease concerns that require a review of established

standards and policies. Nurses are trained to be the change agent when a gap in healthcare or prevention protocol is identified. A simple and foundational strategy that nurses can complete is a synthesis of the literature. Literature syntheses, assembled from studies with the strongest methodologies and disseminated to policy makers, may serve as the stimulus for public policy creation, implementation, or change.

Summary

In this chapter, the principal investigator presented a summary and discussion of this descriptive, correlational study that addressed factors associated with adolescent physical activity and inactivity. Previous research findings identified relevant risk factors for adolescent physical activity and protective resources that promote health and physical activity. The variables, anchored in a modified resilience conceptual model, were to explain adolescent physical activity. The sample consisted of 251 adolescents in Grade 8 and Grade 9 and their parents, who volunteered to participate in the original longitudinal studies. The principal investigator used correlation and regression analyses to answer the research questions. The findings suggested female sex, parent activity, higher levels of ethnic identity, and health awareness were significant predictors of adolescent physical activity. There was only one statistically significant interaction term identified (parental activity x health awareness), but it did not explain any of the variance in adolescent physical activity. Limitations were offered and conclusions drawn from the study findings. Last, implications and recommendations discussed were for nursing practice, research, education, and public policy.

APPENDIX A

IRB APPROVAL

OFFICE OF RESEARCH SUPPORT

THE UNIVERSITY OF TEXAS AT AUSTIN

P.O. Box 7426, Austin, Texas 78713 · Mail Code A3200
(512) 471-8871 · FAX (512) 471-8873

FWA # 00002030

Date: 05/29/13
PI: Cynthia A McAdams
Dept: Nursing
Title: Exploring Adolescent Physical Activity Participation

RE: Non Human Subject Research Determination for IRB Protocol Number 2013-05-0055

Dear Cynthia A McAdams:

The Office of Research Support (ORS) reviewed the above protocol submission request and determined it did not meet the requirements for human subject research as defined in the Common Rule (45 CFR 46) or FDA Regulations (21 CFR 50 & 56). At this time you are free to begin your research as IRB approval is not necessary. You should retain this letter with the respective research documents as evidence that IRB review and oversight is not required.

If you have any questions contact the ORS by phone at (512) 471-8871 or via e-mail at orsc@uts.cc.utexas.edu.

Sincerely,

[redacted]

James Wilson, Ph.D.
Institutional Review Board Chair

APPENDIX B

CONSENT FORM

IRB APPROVED: 05/23/2011 DO NOT USE AFTER: 05/22/2012

IRB# 2006-06-0104
Informed Consent to Participate in Research
The University of Texas at Austin

Your family is being asked to participate in a research study. This form provides you with information about the study. The Principal Investigator (the person in charge of this research) or his/her representative will provide you with a copy of this form to keep for your reference, and will also describe this study to you and answer all of your questions. Please read the information below and ask questions about anything you don't understand before deciding whether or not to take part. Participation of the parent and adolescent is entirely voluntary and either of you can refuse to participate without penalty or loss of benefits to which you are otherwise entitled. If you are a parent, you will be one of 1500 adult participants in the study. If you are an adolescent, you will be one of 1500 adolescent participants in the study.

Title of Research Study: *Developing Health Behaviors in Middle Adolescents*

Principal Investigator(s) (include faculty sponsor), UT affiliation, and Telephone Number(s):
Donna Lynn Rew, Professor, School of Nursing, 512-471-7941.

Funding source: National Institute of Nursing Research

What is the purpose of this study? To determine how health-risk and health-promoting behaviors develop in middle adolescence.

What will be done if you take part in this research study?
The adolescent's parent will be asked to complete a short survey one time only during the first year your adolescent child is enrolled in the study. This survey takes about 20 minutes to complete. The adolescent will be asked to complete a longer survey once each year for a total of 4 years (through high school). The adolescent's survey may take over an hour to complete. Surveys can be completed on laptop computers or by paper if either the parent or adolescent is uncomfortable using a computer.

The Project Duration is: 5 years

What are the possible discomforts and risks?
There are minimal risks for both parents and adolescents who participate in this study. There may be risks that are not known at this time, including loss of confidentiality. Since researchers will be coming into your home, there is the slight risk that the researcher may observe things that your family may wish to remain private. Some of the questions the adolescent is asked will pertain to sensitive behaviors such as substance use and sexuality and and may make him or her uncomfortable or anxious. He or she does not have to answer any questions if they make him or her uncomfortable. There are 5 questions on the adolescent's survey that address thinking about, planning, or attempting suicide. If the adolescent answers these questions positively, the researcher will inform the parent and refer them to a community professional with experience in this area. Resources you may wish to contact are the Austin-Travis County Mental Health Hotline (512-472-4357) or the National Suicide Prevention Lifeline (1-800-273-8255). Both of these contacts speak

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Spanish. If you wish to discuss this issue or any other risks you may experience, you may ask questions now or call the Principal Investigator listed on the top of this page.

What are the possible benefits to you or to others? There are no direct benefits to your family for participating in the study. It may benefit you and your adolescent child by raising your awareness about stress and resources for coping with stress. You both may benefit from discussing your participation in the study. In the event your adolescent child has thought about, planned, or attempted suicide within the previous year, both of you may benefit from having this information disclosed and being referred for professional help.

If you choose to take part in this study, will it cost you anything? There is no cost to you for participating in this study.

Will you receive compensation for your participation in this study? You and your adolescent child will each receive a $25 gift card for each year of data completed. This means that the parent will receive one card the first year of the study only. The adolescent will receive a card each of the 4 years that he or she participates.

What if you are injured because of the study?
There is no known reason why you or your adolescent child would be injured while completing the surveys. The University has no plan to provide compensation for a physical or psychological injury incurred while completing the surveys.

If you do not want to take part in this study, what other options are available to you?
Participation in this study is entirely voluntary. You and your adolescent child are free to refuse to be in the study, and your refusal will not influence current or future relationships with The University of Texas at Austin.

How can you withdraw from this research study and who should you call if you have questions?

If you, as a parent or adolescent, wish to stop your participation in this research study for any reason, you should contact the principal investigator: Donna Lynn Rew at (512) 471-7941. You should also call the principal investigator for any questions, concerns, or complaints about the research. Each of you is free to withdraw your consent and stop participation in this research study at any time without penalty or loss of benefits for which you may be entitled. Throughout the study, the researchers will notify you of new information that may become available and that might affect your decision to remain in the study.

In addition, if either of you (parent or adolescent) has questions about your rights as a research participant, or if you have complaints, concerns, or questions about the research, please contact Jody Jensen, Ph.D., Chair, The University of Texas at Austin Institutional Review Board for the Protection of Human Subjects, or the Office of Research Compliance and Support at (512) 471-8871.

How will your privacy and the confidentiality of your research records be protected?
All data will be linked with a code number. Your names will be removed from the data and a list of code numbers and names will be kept in a locked file in the investigator's research office at the School of Nursing. If the researchers should observe or receive reports of child abuse, including sexual abuse, confidentiality will be broken because state law requires the reporting of abuse to Child Protective Services or the Texas Department of Family and Protective Services.

The data resulting from your participation may be made available to other researchers in the future for research purposes not detailed within this consent form. In these cases, the data will contain no identifying information that could associate you with it, or with your participation in any study.

If in the unlikely event it becomes necessary for the Institutional Review Board to review your research records, then the University of Texas at Austin will protect the confidentiality of those records to the extent permitted by law.

To help us protect your privacy, we have obtained a Certificate of Confidentiality from the National Institutes of Health. With this Certificate, the researchers cannot be forced to disclose any information that may identify you, even by a court subpoena, in any federal, state, or local civil, criminal, administrative, legislative, or other proceedings. We will use the Certificate to resist any demands for information that would identify you. This Certificate cannot be used to resist a demand for information from personnel of the United States Government that is used for auditing or evaluation of Federally funded projects or for information that must be disclosed to meet requirements of the Federal Food and Drug Administration. You should understand that a Certificate of Confidentiality does not prevent you or a member of your family from voluntarily releasing information about yourself or your involvement in this research. If an employer, insurer, or other person obtains your written consent to receive research information, then the researchers may not use the Certificate to withhold that information. The researchers do not intend to voluntarily disclose any information provided by you as part of this study.

Because this research is sponsored, the National Institutes of Health will also have the legal right to review your research records. When the results of this research are published or presented at scientific meetings, your identity will not be disclosed.

Will the researchers benefit from your participation in this study? The only benefits to the researchers are the opportunities to publish and present the findings.

Signatures:

As a representative of this study, I have explained the purpose, the procedures, the benefits, and the risks that are involved in this research study:

_____

Signature and printed name of person obtaining consent **Date**

You (parent) have been informed about this study's purpose, procedures, possible benefits and risks, and you have received a copy of this form. You have been given the opportunity to ask questions before you sign, and you have been told that you can ask other questions at any time. You voluntarily agree to participate in this study. By signing this form, you are not waiving any of your legal rights.

Printed Name of Subject **Date**

Signature of Subject **Date**

Signature of Principal Investigator **Date**

I (adolescent) have read the description of the study titled Developing Health Behaviors in Middle Adolescence that is printed above and I understand what the procedures are and What will happen to me in the study. I understand that there are sensitive questions about I (adolescent) have read the description of the study titled Developing Health Behaviors in smoking, drinking, using drugs, suicide, and sexual activity. I also understand that I do not have to answer any questions that make me uncomfortable. I have received permission from my parent(s) to participate in the study and I agree to participate in it. I know that I can quit the study at any time by telling my parent or the Principal Investigator.

Signature of Adolescent **Date**

APPENDIX C

INSTRUMENTS

Parent Questionnaire: Demographic Information Form

1. What is this adolescent's ethnicity? 1 – Hispanic/Latino 2 – Non-Hispanic

2. What is this adolescent's race? (Please answer 'yes' or 'no' for each item):
    a. Black or African American? ___Yes ___No
    b. Native Hawaiian/Pacific Islander ___Yes ___No
    c. Asian? ___Yes ___No
    d. American Indian/Alaskan Native ___Yes ___No
    e. White/Caucasian? ___Yes ___No
    f. Other (please specify): ___Yes ___No

BMI

Grade 8, Demographics

Full Name: _____

Birth date: Month_____Day___Year_____

Today's date: _____

School Name: _____

1. Are you a boy or a girl? _____boy _____girl

2. How tall are you without your shoes on?

    _____feet _____inches

3. How much do you weight without your shoes on?

    _____pounds

Media Use Scale

Indicate how often you use each of the following on a daily basis. Circle the appropriate number that corresponds to your answer.

In your room at home:	**Not at All**	**Less than 3 hours/day**	**3-5 hours/day**	**More than 5 hours/day**
1. Television with cable	1	2	3	4
2. Television without cable	1	2	3	4
3. Fashion magazines	1	2	3	4
4. Teen magazines	1	2	3	4
5. Video game console such as Xbox, Playstation	1	2	3	4
6. Radio	1	2	3	4
7. Computer	1	2	3	4
8. Computer with internet access	1	2	3	4
9. CD player	1	2	3	4
10. VCR/DVD player	1	2	3	4
In your home, but not in your room:	**Not at All**	**Less than 3 hours/day**	**3-5 hours/day**	**More than 5 hours/day**
11. Television with cable	1	2	3	4
12. Television without cable	1	2	3	4
13. Fashion magazines	1	2	3	4
14. Teen magazines	1	2	3	4
15. Video game console such as Xbox, Playstation	1	2	3	4
16. Radio	1	2	3	4
17. Computer	1	2	3	4
18. Computer with internet access	1	2	3	4
19. CD player	1	2	3	4
20. VCR/DVD player	1	2	3	4
Outside your home:	**Not at All**	**Less than 3 hours/day**	**3-5 hours/day**	**More than 5 hours/day**
21. Television with cable	1	2	3	4
22. Television without cable	1	2	3	4
23. Fashion magazines	1	2	3	4
24. Teen magazines	1	2	3	4
25. Video game console such as Xbox, Playstation	1	2	3	4
26. Radio	1	2	3	4
27. Computer	1	2	3	4
28. Computer with internet access	1	2	3	4
29. CD player	1	2	3	4
30. VCR/DVD player	1	2	3	4

Parent Health Risk Survey

During the past month, how often did you:

1 = Rarely or never 2 = A few times 3 = Fairly or often 4 = Very Often

1. Take time (15 to 30 minutes) to exercise vigorously (for example: running, swimming, briskly walking)? 1 2 3 4

2. Take time (15 to 30 minutes) to perform exercises that enhance muscle tone (for example: yoga, running in place, calisthenics, weight training)? 1 2 3 4

3. Spend part of your leisure time in individual, family, or Team activities that involve some form of a physical workout (for example: golf, bowling, baseball, gardening, or housework)? 1 2 3 4

Multi-Group Measurement of Ethnic Identity (MMEI)

Please indicate how you feel about your ethnicity or ethnic group.

1. I have spent time trying to find out more about my own ethnic group, such as its history, traditions, and customs.
   1- Strongly agree 2- Somewhat agree 3- Somewhat disagree 4- Strongly disagree

2. I am active in organizations or social groups that include mostly members of my own ethnic group.
   1- Strongly agree 2- Somewhat agree 3- Somewhat disagree 4- Strongly disagree

3. I have a clear sense of my ethnic background and what it means for me.
   1- Strongly agree 2- Somewhat agree 3- Somewhat disagree 4- Strongly disagree

4. I think a lot about how my life will be affected by the ethnic group I belong to.
   1- Strongly agree 2- Somewhat agree 3- Somewhat disagree 4- Strongly disagree

5. I am happy that I am a member of the group I belong to.
   1- Strongly agree 2- Somewhat agree 3- Somewhat disagree 4- Strongly disagree

6. I am not very clear about the role of my ethnicity in my life.
   1- Strongly agree 2- Somewhat agree 3- Somewhat disagree 4- Strongly disagree

7. I really have not spent much time trying to learn more about the culture and history of my ethnic group.
   1- Strongly agree 2- Somewhat agree 3- Somewhat disagree 4- Strongly disagree

8. I have a strong sense of belonging to my own ethnic group.
   1- Strongly agree 2- Somewhat agree 3- Somewhat disagree 4- Strongly disagree

9. I understand pretty well what my ethnic group membership means to me, in terms of how to relate to my own group and other groups.
   1- Strongly agree 2- Somewhat agree 3- Somewhat disagree 4- Strongly disagree

10. In order to learn more about my ethnic background, I have often talked to other people about my culture.
    1- Strongly agree 2- Somewhat agree 3- Somewhat disagree 4- Strongly disagree

11. I have a lot of pride in my ethnic group and its accomplishments.
    1- Strongly agree 2- Somewhat agree 3- Somewhat disagree 4- Strongly disagree

12. I participate in cultural practices of my own group, such as special food, music, or customs.
    1- Strongly agree 2- Somewhat agree 3- Somewhat disagree 4- Strongly disagree

13. I feel a strong attachment towards my own ethnic group.
    1- Strongly agree 2- Somewhat agree 3- Somewhat disagree 4- Strongly disagree

14. I feel good about my cultural or ethnic background.
    1- Strongly agree 2- Somewhat agree 3- Somewhat disagree 4- Strongly disagree

Adolescent Lifestyle Questionnaire: Health Awareness Subscale

Please circle the answer that is honest for you.		Never	Rarely	Some-times	Often	Almost Always	Always
1.	I report any unusual changes in my body to others such as a nurse, my parents, friends, or physician.	1	2	3	4	5	6
2.	I talk to the health teacher/nurse about ways to improve my health.	1	2	3	4	5	6
3.	I read pamphlets, teen magazines about health topics of interest.	1	2	3	4	5	6
4.	I discuss health concerns with others such as friends, family, coaches, health nurses, teachers.	1	2	3	4	5	6

Social Connectedness Scale

Circle the number that shows how you feel.

		Very much	Some	A little	None
1.	How much do you feel that adults care about you?	1	2	3	4
2.	How much do you feel that school people care about you?	1	2	3	4
3.	How much do you feel that your parents care about you?	1	2	3	4
4.	How much do you feel that your friends care about you?	1	2	3	4
5.	How much do you feel that church leaders care about you?	1	2	3	4
6.	How much do you feel that your family cares about your feelings?	1	2	3	4
7.	How much do you feel that people in your family understand you?	1	2	3	4
8.	How much do you feel that you and your family have lots of fun together?	1	2	3	4
9.	How much do you feel that you get upset at home?	1	2	3	4
10.	How much attention does your family give you?	1	2	3	4

Adolescent Lifestyle Questionnaire: Physical Activity Participation

Please circle the answer that is honest for you.		Never	Rarely	Some-times	Often	Almost Always	Always
1.	In an average week, I exercise 3-4 times such as running, taking long walks, dancing, playing ball, swimming.	1	2	3	4	5	6
2.	I participate in a regular program of sports/exercise at school.	1	2	3	4	5	6
3.	I exercise vigorously for 20-30 minutes at least 3 times per week.	1	2	3	4	5	6
4.	I play sports at least 3 times per week.	1	2	3	4	5	6

YRBSS Physical Activity, Grade 8 and Grade 9

The next questions are about physical activity.

1. On how many of the past 7 days did you exercise or participate in physical activity for **at least 20 minutes that made you sweat and breathe hard**, such as basketball, soccer, running, swimming laps, fast bicycling, fast dancing, or similar aerobic activities?
   1 -0 days
   2 -1 day
   3 -2 days
   4 -3 days
   5 -4 days
   6 -5 days
   7 -6 days
   8 -7 days

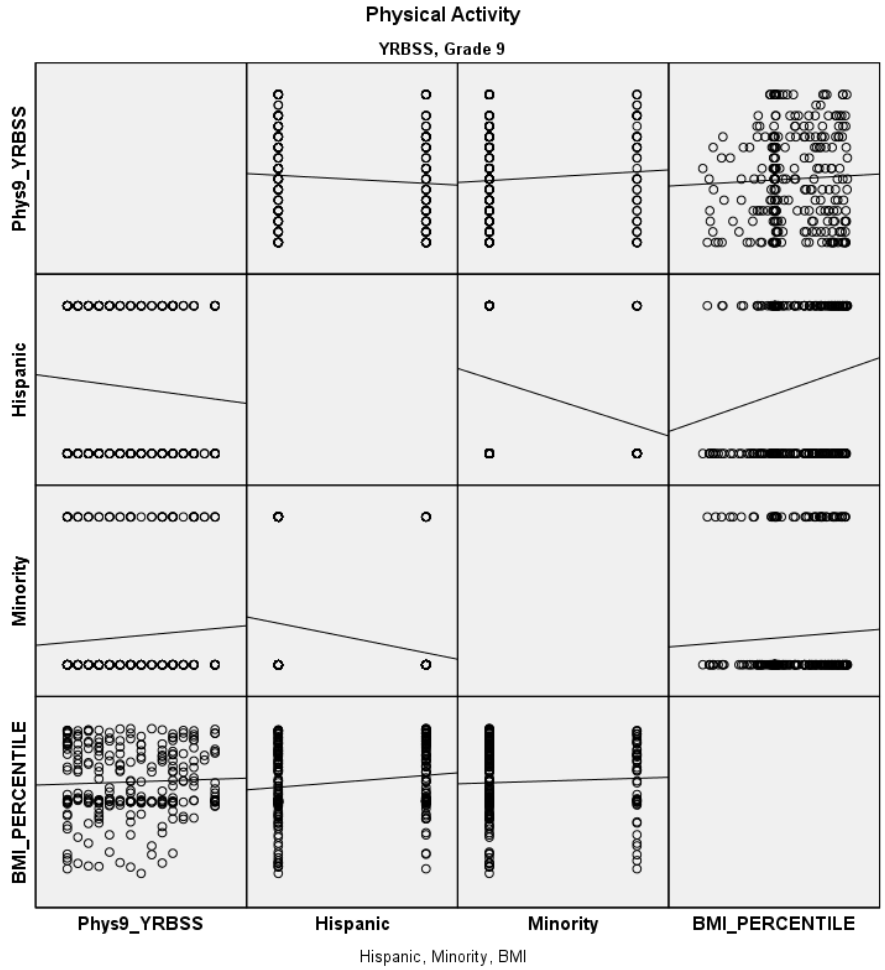
2. On how many of the past 7 days did you do exercises to **strengthen or tone your muscles**, such as push-ups, sit-ups, or weight lifting?
   1 -0 days
   2 -1 day
   3 -2 days
   4 -3 days
   5 -4 days
   6 -5 days
   7 -6 days
   8 -7 days

APPENDIX D

CORRELATION COEFFICIENTS – PYSICAL ACTIVITY

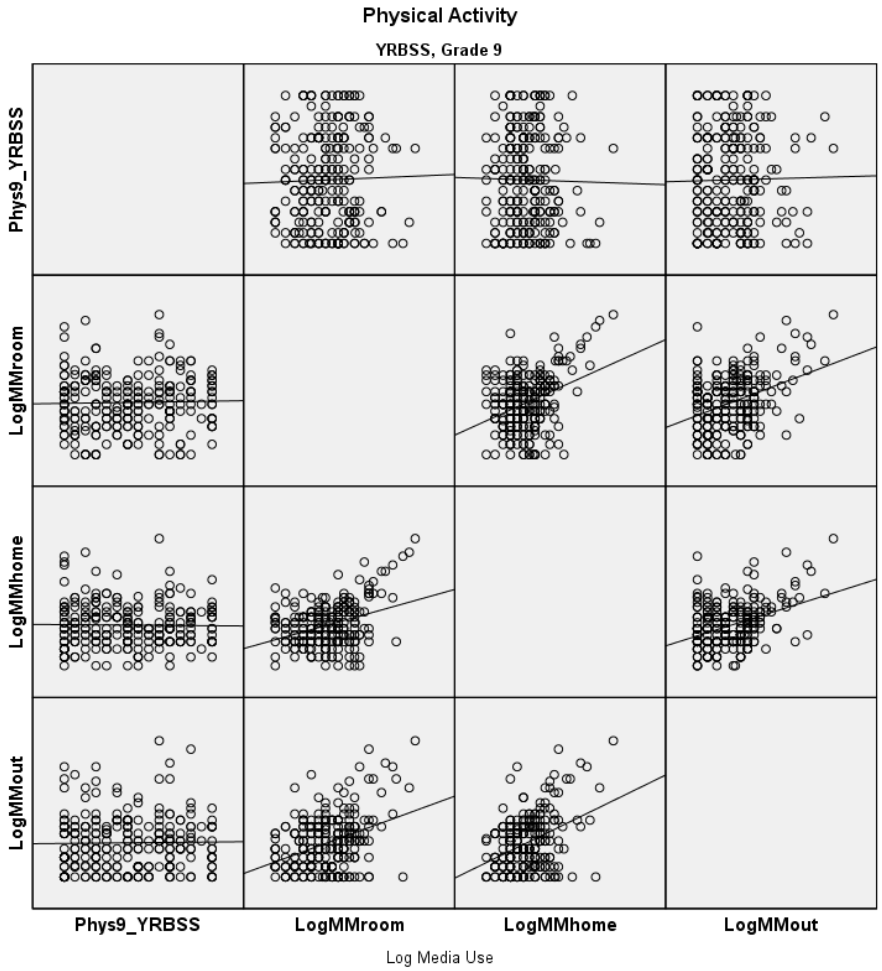
YRBSS9 – HISPANIC, MINORITY, BMI

Variable	Correlation	Significance
1. Minority Race	.075	.239
2. Hispanic Ethnicity	-.086	.174
3. BMI Percentile	.043	.493



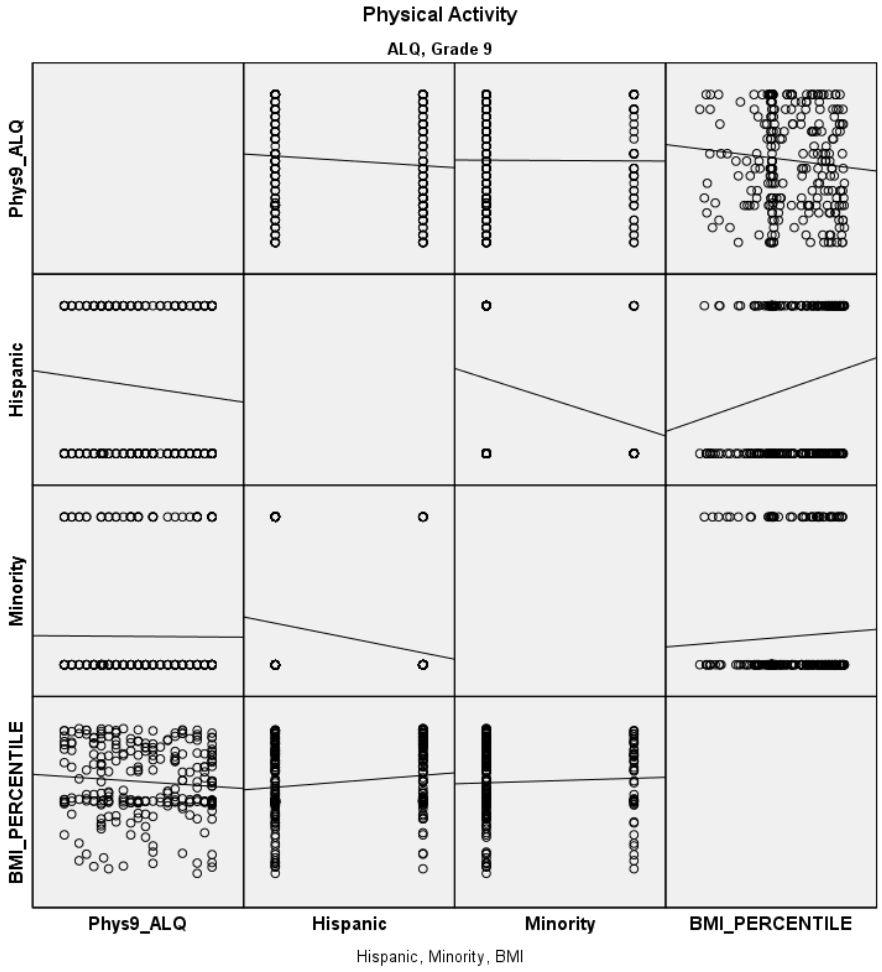
YRBSS9 – LOG MEDIA USE

Variable	Correlation	Significance
1. Log Media (room)	.025	.692
2. Log Media (home)	-.016	.802
3. Log Media (out)	.016	.796



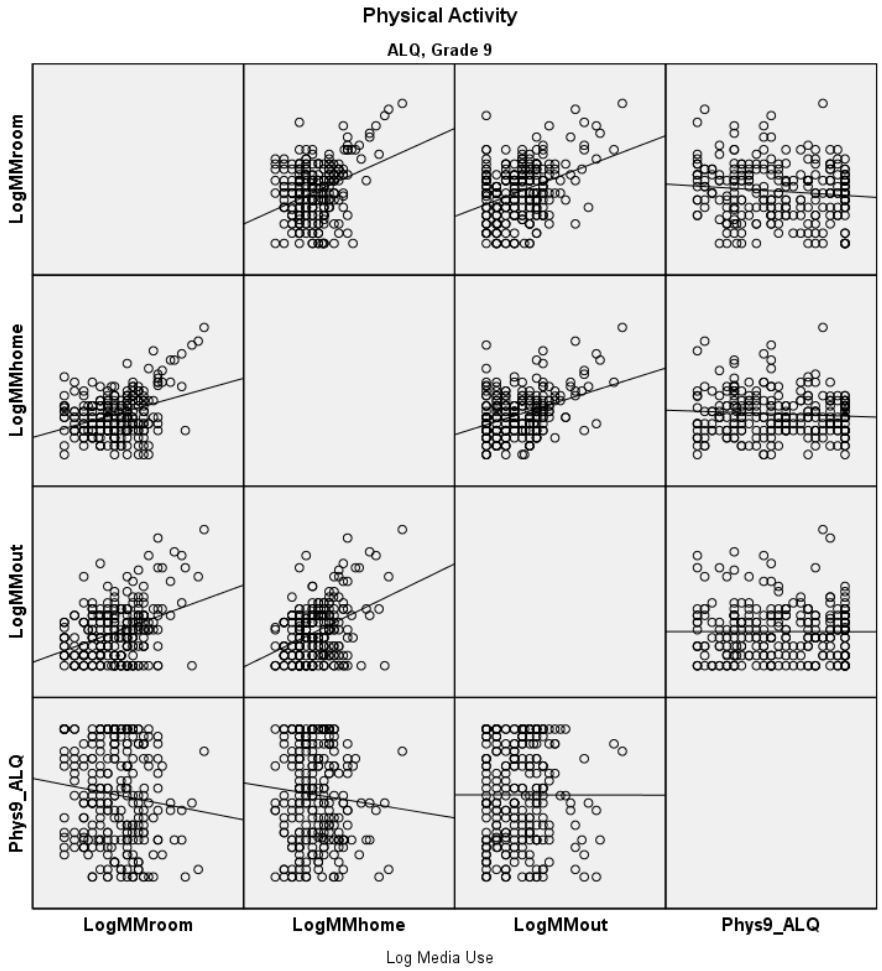
ALQ9 – HISPANIC, MINORITY, BMI

Variable	Correlation	Significance
1. Minority Race	-.006	.924
2. Hispanic Ethnicity	-.099	.120
3. BMI Percentile	-.092	.148



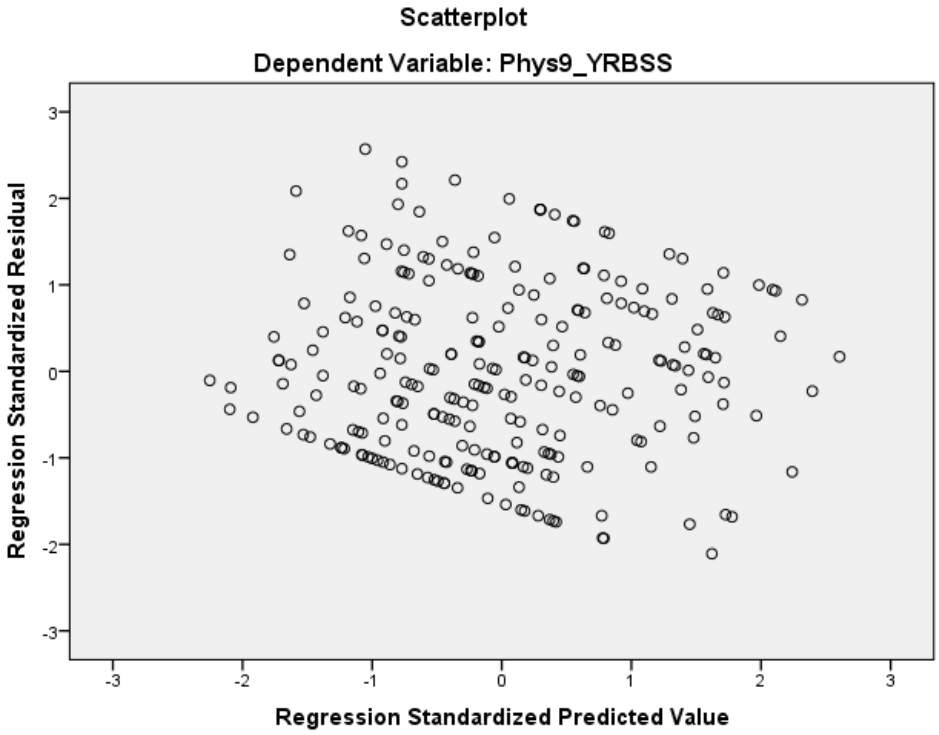
ALQ9 – LOG MEDIA USE

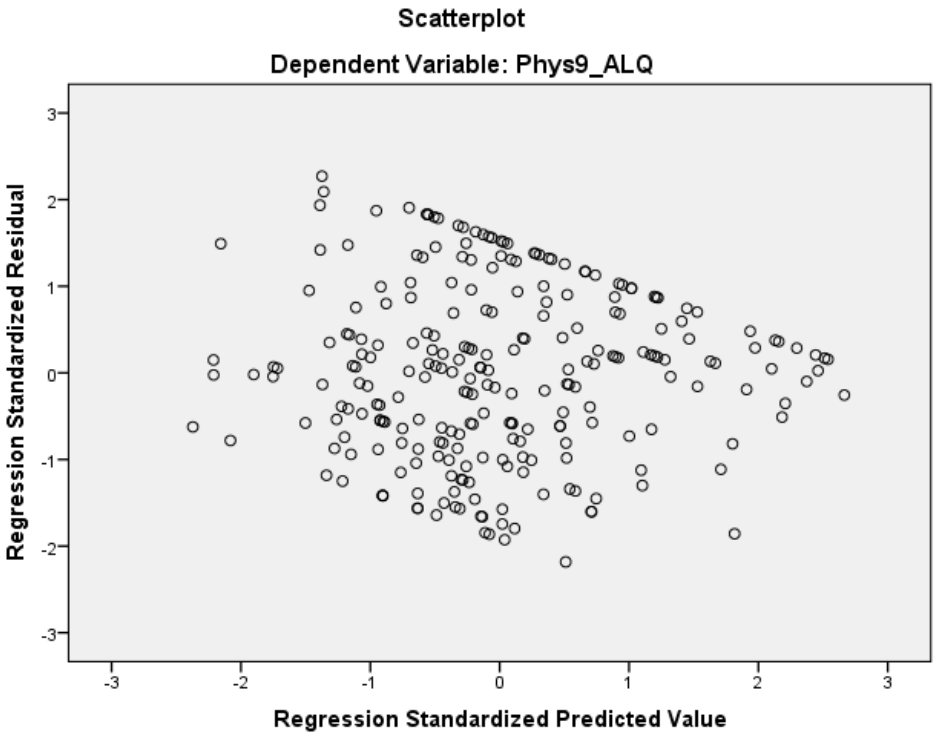
Variable	Correlation	Significance
1. Log Media (room)	-.111	.079
2. Log Media (home)	-.074	.244
3. Log Media (out)	-.001	.099



APPENDIX E

STANDARDIZED REGRESSION RESIDUALS AND PREDICTED VALUES

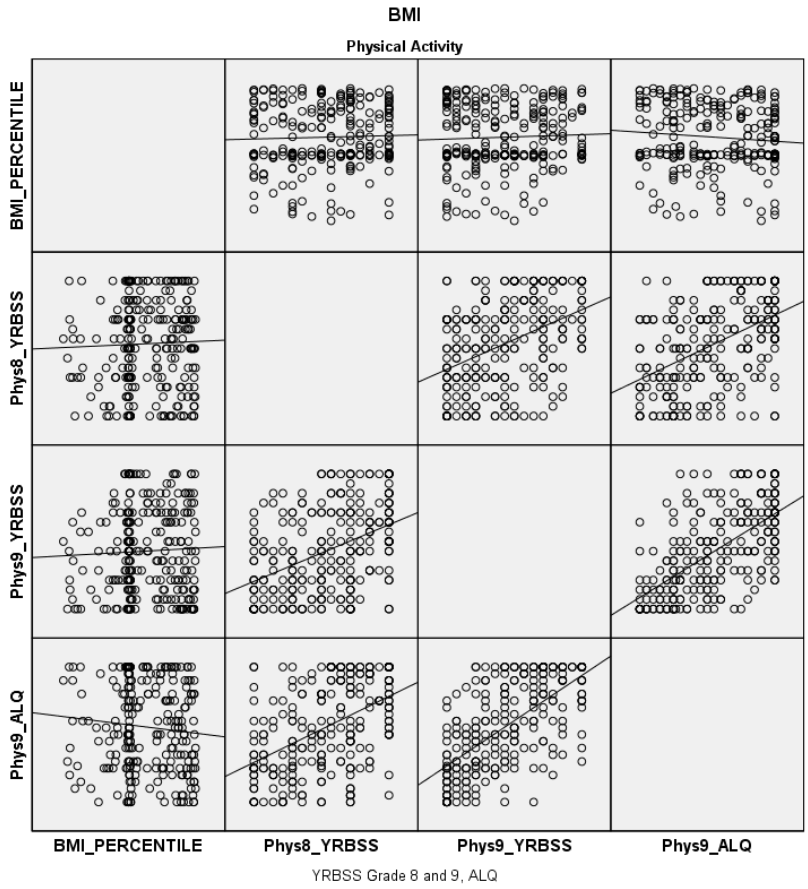



Scatterplot
Dependent Variable: Phys9_ALQ
Regression Standardized Residual
Regression Standardized Predicted Value
3
2
1
0
-1
-2
-3
-3
-2
-1
0
1
2
3

APPENDIX F

CORRELATION COEFFICIENTS – YRBSS GRADE 8 AND 9, ALQ – BMI PERCENTILE

Variable	Correlation	Significance
1. YRBSS 8	.034	.593
2. YRBSS 9	.043	.496
3. ALQ 9	-.092	.148



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